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ANNUAL REPORT

1967-68

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24 JUN 1969

DEPARTMENT OF AGRICULTURE

NEW SOUTH WALES

No. 44

1968

(SECOND SESSION)

PARLIAMENT OF NEW SOUTH WALES

REPORT

OF THE

DEPARTMENT OF AGRICULTURE

FOR THE

Year ended 30 June, 1968

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ADMINISTRATIVE AND SENIOR EXECUTIVE PERSONNEL *

As at 30th June, 1968

Minister	Hon. G. R. Crawford, M.L.A.
Director-General	R. M. Watts.
Deputy Director-General (R.E.)	Dr F. C. Butler.
Deputy Director-General (P.T.)	B. Owen French.
Secretary	J. L. Hager.
Accountant	K. A. Russell.
Chiefs of Divisions—	
Animal Industry Division	R. A. Hall.
Dairy Division	D. W. Crowfoot.
Horticulture Division	R. G. Kebby.
Plant Industry Division	W. H. G. Poggendorff.
Science Services Division	T. H. Johns.
Marketing and Agricultural Economics Division	C. J. King.
Information Services Division	H. Parry Brown.
Extension Services Division	B. D. Ament.
Chief, Research Stations Branch	N. K. Golding.
Principals, Major Agricultural Colleges—	
Hawkesbury Agricultural College	B. Doman.
Wagga Agricultural College	B. F. Atkins.
Royal Botanic Gardens and National Herbarium—	
Director and Chief Botanist	N. K. Mair.

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* For more detail of staff of the various Divisions, Branches, Institutions, Regions, etc., see the Department's brochure *Directory of Officers*. For staff numbers see *Appendix III* of this Report.

NEW SOUTH WALES

DEPARTMENT OF AGRICULTURE

Report of the Director-General to the Minister for the Year ended 30th June, 1968

Department of Agriculture, Sydney, 8th October, 1968.
Dear Sir,

Herewith the Report of the Department of Agriculture for the 12 months ended 30th June, 1968.

NOTES FROM CENTRAL ADMINISTRATION

Notes on the Seasons

Taking as a whole the 12 months from the end of June, 1967: they opened with most of New South Wales in reasonable condition, but the drought greatly worsened over the 6 months to the end of 1967; then in the new year the situation improved until by June, 1968, the pastoral outlook was again promising—except in the southeastern corner and in the Cobar area of Western Division.

Exceptions to reasonable condition at the start of the 12 months in July, 1967, were: waterlogged parts of the north coast; drought affected southern parts of Western Division, and similarly affected southwestern slopes areas and the Riverina.

Other than in central and south coastal and central tableland areas, rainfall was generally below average up to the end of September, 1967. Pasture and fodder crops were holding on fairly well except in the inland south and southern Western Division. Then the drying winds, and lack of follow-up rains in September, brought deterioration in most areas.

Conditions continued to worsen until mid-October, especially on the southwestern slopes and in the Riverina and southern Western Division. There, drought or semi-drought prevailed. Mid-spring rains widespread gave some relief but short-lived. Subsequent rainfall registrations, to the end of 1967, were in general below average.

By the close of the calendar year 1967 the position was grim in many districts, and rapidly deteriorating except in the northeastern quarter. This quarter was still reasonable in terms of stock feed, but elsewhere feed was very limited—and even some of the irrigation areas were suffering.

Temperatures for the final quarter of 1968 were mostly above average. Heatwave conditions were in many areas late in January and again in February, 1968.

Excellent rains fell in most northern and central districts in the first half of January, in fact causing moderate to severe flooding in some places. The critical inland southern areas also recorded useful rains, later in January.

The January rains, the best summer rains for years, dramatically changed the pastoral outlook over most of the State and replenished subsoil moisture reserves. A drawback was the heat in late January and in the mostly dry February. This retarded pasture and crop growth, except in some northern areas where there were moderate February rains.

Rain was widespread late in March, with better falls in northern and central districts. By the end of March most of the north and central coasts and the northern tablelands were enjoying a good season and the inland northern and many central areas were reasonable.

Unfortunately the south, not having had the January rains had further deteriorated in February, and despite a little relief by the late March rains was in very grim condition at the end of March. Hand feeding was by now widespread there, and movement of southern stock to northern agistments had intensified over that first quarter of the new calendar year.

April rains were above average only in western and southwestern districts, but the State as a whole had moderate to very heavy rains in May. June rains were mostly below normal, though there were some useful southwestern falls early in that month.

May's drought-breaking rains greatly eased the pastoral situation, particularly in the southern and some southwestern areas. Winter pasture germination was stimulated, and fodder crops responded well.

With onset of cold, windy weather subsequent growth was slow. Marked improvement before the spring was not expected. Even so, at the end of June, 1968, most districts were showing good recovery from the generally low point of six months earlier. This was especially so in inland southern localities and these as a result faced the late winter and early spring with favourable prospects.

Main exceptions to the favourable prospects at the end of June, 1968, were the south coast and adjacent tableland areas. Dramatic improvement was needed in those parts to avoid a hard winter and desperate spring.

Following the May rains, considerable numbers of stock—mainly sheep—were returned from northern agistments to the properties of origin in the south.

The excellent May rains greatly enhanced the prospects for the 1968–69 wheat crop. Most of the State's intended wheat acreage had been sown by the end of June.

Wheat sowings were estimated by the Department to have totalled in excess of 10,000,000 acres; well above the record 8,400,000 acres sown in 1967. The subsoil moisture situation is more favourable than a year earlier, and a very heavy crop—probably a record—is a reasonable expectation provided seasonal conditions remain favourable in ensuing months.

Notes on Cloud Seeding

Operational Statistics.—The two-plane operation continued, from bases at Cobar and Wagga.

From the 19 months of continuous Cobar operations it is evident there is sufficient cloud seeding work in the far west of New South Wales to keep at least one aircraft fully engaged. Nine months' statistics from Cobar are: flew on 131 days; 480 hours flying; seeding on 74 of the 131 flying days; seeded for 152 of the 480 flying hours (31 per cent of the flying time).

May, 1968, was a very active period of seeding, from Wagga base in particular. Sixty-two hours were flown and 34 were seeding hours; a very high ratio.

Achievements.—There is no formula to measure success of *ad hoc* cloud seeding operations; and assessment is particularly difficult in the winter when seeding is usually in stratiform clouds. In summer, cumulus clouds are frequently seeded and visual assessments often possible. For the scientist, the visuals are unacceptable. Even so, the Department's cloud seeding officers' observations are recorded, indicating seeding's worthwhile contribution to precipitation. If suitable clouds are seeded, rain does fall. There is a chance that no precipitation would occur without the added impetus of silver iodide.

Co-operative work with the CSIRO to determine whether seeding in the west will increase precipitation in areas further east has progressed. Some difficulties are now being discussed.

Training of Officers.—This year four potential cloud-seeding officers attended the third course of instruction in cloud-seeding techniques, conducted by the CSIRO Division of Radiophysics. Also, two senior officers of other Divisions attended, as did two qualified cloud-seeding officers and the special agronomist (irrigation). The pupil cloud-seeding officers had preliminary flying training before the school. One had further intensive training after the school, and relieved the permanent cloud-seeding officer for the whole of May.

Notes on Commodity Production

Production of the major cereal crops in 1967–68 obviously could not in the drought conditions reach the record levels of the previous year. There were exceptions however, and some exceptions also in crops other than cereals, as indicated by the following notes:

CEREALS

Wheat—Record Acreage but Low Production

Some 8,400,000 acres were sown (8,200,000 for grain); a record well above the previous record 7,320,000 acres. But because of drought at least 1½ million acres failed for grain. Yield average of the harvested grain acreage was 10.7 bushels/acre; as against the 28.6 bushels/acre averaged in 1966–67.

The near 89,000,000 bushels crops in 1967–68 was the fifth from highest on record for New South Wales and, except for the drought devastated 1965–66 crop of 39,000,000 bushels, was the lowest since 1961–62.

Oats—Lower Acreage and Low Yield

The oat-grain harvest was finally calculated as 8,236,000 bushels; an 80 per cent fall from the record of 41,000,000 bushels in the previous season. Yield average of 9.1 bushels/sown acre was far from the 1966–67 record 30 bushels/acre.

Area sown to oats for all purposes approximated 1,811,200 acres (907,500 for grain). Comparative 1966–67 figures were 2,186,000 sown for all purposes (1,363,000 for grain).

Barley—High Acreage, Low Yield

Interest in barley, for feed grain and for malting, continued high.

The sown acreage for 1967–68 was calculated as close to the record 431,700 acres, for all purposes, sown for 1966–67. But grain production barely exceeded 4,800,000 bushels; less than half the record 1966–67 production of 11,800,000 bushels.

Yield average of 13.2 bushels/acre in 1967–68 contrasted with the record 30.6 achieved in 1966–67.

Maize—High Acreage, Good Production

The estimated 1967–68 sowing was 67,000 acres; as against 70,500 acres in 1966–67 but also as against the 42,000 acres in 1965–66.

Despite the conditions the estimated production was 3¼ million bushels—a total not exceeded in any year since the late 1930's. The record production was in 1910: 7,594,100 bushels.

Grain Sorghum—Record Acreage, Record Production

The estimated 3¼ million bushels produced and the estimated 133,000 acres sown for the 1967–68 season were records for New South Wales.

In the new and the established irrigation areas an estimated 70,000 acres was harvested and the yield average for irrigated acres was about 1.7 ton/acre, compared with 0.8 ton/acre from rain-grown crops. Some irrigated crops yielded 3 to 4 ton/acre.

Rice—Further Acreage and Production Records

Production exceeded 217,000 tons of paddy. This was from 76,000 acres. Previous records were 210,939 tons, and 73,820 acres, in 1966–67.

Yield average for 1967–68 equalled the world record 2.86 ton/acre achieved in New South Wales in 1966–67, and would have exceeded it but for bad harvesting weather in May/June, 1968.

FIBRE AND OIL CROPS, ETC.

Cotton—Record Acreage, Production, and Yield Average

The estimated 51,200 acres and the estimated 114,000 bales produced are records for New South Wales. Yield average, estimated at 2.23 bale/acre, was also a record. Previous acreage, production record and yield average record were in 1965–66; respectively 33,176 acres; 71,720 bales; 2.17 bale/acre.

These are amazing performances for an industry so recently founded that only five years ago the production was 2,075 bales from 2,360 acres.

Some of the Interesting Lesser Crops

Tobacco.—The estimated 1,789 acres of tobacco was mostly in the Ashford-Bonshaw-Yetman districts of northern New South Wales and comparable with the 1,765 acres in 1966–67. Yield average appeared to improve and was estimated as in excess of 1,200 lb/acre—possibly as high as 1,250 lb/acre. There have been indications that the overall satisfactory prices at the early tobacco sales have encouraged growers to prepare extra acreage for 1968–69.

Soybeans.—The estimated 600 acres sown was the biggest total yet sown in this State. Most of the acreage was irrigated. Yield average was in excess of one long ton (37⅓ bushels) per acre, and the best crop reported was at 56 bushels per acre. Soybean research has been given new status associated with the potential of the crop under irrigation in the north west. A research agronomist has been appointed to specialize in soybean.

Linseed.—With the continued limited market in Australia, the 1967–68 area remained at about 9,500 acres—as in the preceding season. In the year's drought conditions the yield average, less than 8 bushels per acre, was little more than half of the 1966–67 achievement.

Safflower.—The area in 1967–68 climbed steeply to an estimated 13,000 acres; as against 5,100 acres in 1966–67. But yield average was estimated at only 5.5 bushels/acre, as against 14.1 bushels/acre in 1966–67. The low yields, in some cases, were because of insufficient soil moisture to mature the crop. In other cases, there was germination of grain in the head—by summer rain.

FRUIT AND ALLIED INDUSTRY

Record Citrus Production

The final estimate of citrus production for New South Wales in 1967–68 was 6,890,000 bushels for the main crop plus 380,000 bushels of summer crop lemons and 190,000 bushels of second crop lemons, giving an overall production of 7,460,000 bushels. This is a record for the State. Production was 6,100,000 bushels in 1966–67 and 4,640,000 bushels in 1965–66. Indications are that production will continue to increase up to a total of between 9 and 10 million bushels by the early 1970's.

Pome Fruit Production

The estimated New South Wales apple crop for 1967–68 is 3 million bushels compared with a pack of 3.42 million bushels in 1966–67. The pear crop has been estimated as 525,000 as against 620,000 bushels in 1966–67.

The smaller crops, compared with the previous season, are partly explained by cumulative effect of several unfavourable growing seasons and partly by a particularly severe infestation of thrips during blossoming.

Stone Fruit Production

Big Canning Peach Crop.—Deliveries of peaches to canneries in 1967–68 amounted to 21,226 tons, only 58 tons less than the record set in the previous year. This was a far higher production than anticipated early in the season. Although fruit was generally smaller, canneries accepted peaches of 2¼ in diameter as against the normal 2⅜ in. This helped the tonnage. Also, losses from brown rot were lower than frequently occur.

Low Prune Crop.—Under the drought conditions there was almost a complete failure of prunes in the Young district. There, only about 130 ton was produced compared with a normal crop of 2,000 ton. The crop at Griffith also was lighter than in recent years. Total New South Wales production for 1967–68 is not expected to exceed 1,300 tons; as against the record 5,316 tons in 1966–67.

Record Banana Production

Banana production in N.S.W. for 1967–68 amounted to a record 4,840,180 bushels; 1,200,000 bushels more than in the previous year. It was achieved from 23,469 acres and reflects a high standard of plantation management. This has lifted average production per acre to 206 bushels, the highest ever for N.S.W. Contributing factors are the higher plant density per acre, eradication of marginal-economic plantings, and the increased proportion of comparatively young plantations.

Grape and Wine Industry—Further Records

Wine Production.—For the 1968 vintage this is expected to total 8,400,000 gallons as against the previous record of 7,893,255 gallons made in 1967.

Wine Grapes.—In the M.I.A., the State's largest wine producing district, 40,550 ton of wine grapes were harvested compared with the record 41,669 ton produced in 1967. In the high quality Hunter Valley district it is estimated that 2,200 ton were harvested, compared with 2,088 ton in 1967.

The continually increasing demand for table wines in Australia has further stimulated the planting of wine grapes in N.S.W., particularly because of proximity to the large markets in Sydney and Melbourne. Despite the increase, supplies of wine grapes are lagging well behind demand and a substantial extension of plantings in the M.I.A. is needed if winemakers' projected requirement of 50,000 ton by 1970 are to be met. Hunter Valley developments are speeding up and it seems likely that the present 1,760 acres there will be doubled within a few years.

Table Grapes.—Production was estimated as 10,000 ton, compared with 8,200 ton in 1966–67, and this would be a record for N.S.W.

Dried Vine Fruits.—Production was estimated as 12,503 ton (dried weight), as against the record 1966–67 production of 14,951 ton.

MEAT PRODUCTION

Only preliminary figures are available as yet. These include the following:

Beef and Veal

Production in 1967–68 approximated 220,850 tons, compared with 209,400 in 1966–67, but even so was the second from lowest since 1960–61 and well below the record 303,400 tons in 1964–65.

Mutton and Lamb

Production was 200,750 tons, compared with 173,850 in 1966–67, and the 1967–68 output was actually the second from highest on record. It has been exceeded only by the 202,050 tons output in 1963–64.

Pig Meats, and Bacon and Ham

Production of pig meats other than bacon and ham totalled 40,970 tons, compared with 38,280 ton in 1966–67.

Bacon and ham output reached 14,780 ton, compared with 15,360 in 1966–67.

Poultry Meats

Further big increase in production made 1967–68 notable. Production, at about 49,500 ton, showed a 17 per cent rise on the 42,310 ton produced in 1966–67.

Meat chicken hatchings increased to 37.6 million hatched, as against 34.2 million in 1966–67 and 26.1 million in 1965–66. There was overproduction, reflected in the lower prices.

Turkey production has also increased; from 340,000 birds slaughtered in 1965–66 to 486,000 in 1967–68.

DAIRY PRODUCTION

Factory butter production in 1967–68 was 31,820 tons, falling sharply from the 38,570 tons in 1966–67. Factory cheese output was 4,840 tons, compared with 5,000 tons the season before. Production of milk in the Whole Milk Zone reached 158,918,000 gallons; compared with the 159,353,000 gallons in 1966–7.

EGGS

Commercial egg production leaped to a new record of 74,681,000 dozen, and easily exceeded the previous record of 68,043,000 dozen in 1966–67. This 1967–68 output was 20,000,000 greater than the output as recently as six years ago.

WOOL

First-hand deliveries of wool from the 1967–68 wool clip into the three main broker stores, Sydney, Newcastle, and Goulburn, totalled 1,423,345 bales during the 12 months ended June, 1968; compared with 1,310,955 bales in the previous 12 months.

Total receivals during 1967–68, including carryover from the previous season and wool received for re-sale, were 1,521,959 bales. Of these, 1,455,380 bales were sold. Total receivals in the previous 12 months were 1,396,221 bales. Of these 1,320,239 bales were sold.

After excluding 3,138 bales shipped overseas for sale, 63,441 unsold bales were held in store at the end of June, 1968.

STOCK NUMBERS

Sheep

At the end of March, 1968, the number of sheep and lambs in New South Wales was estimated at 67,500,000; some 3,650,000 more than at March, 1967, but still fairly well below the record 72,400,000 in March, 1965.

Cattle

Cattle in New South Wales at the end of March, 1968, were estimated at 4,550,000, a rise of 405,000 over the March, 1967, figure of 4,145,000. At this rate the cattle population should within a few years exceed the March, 1964, record of 4,789,000.

Pigs

The number of pigs in New South Wales was estimated at a record 645,100 and well above the 513,500 in March, 1967.

Notes on Some Committees, Councils, Trusts

STANDING COMMITTEE ON DROUGHT RELIEF

When the former Chairman Mr J. L. Green retired, the Acting Chief of Regional Extension Services Mr B. D. Ament became Chairman, but when Mr Ament became Chief of the Department's new Division of Extension Services with additional responsibilities the Chief of Research Stations Branch Mr N. K. Golding was appointed Chairman of the Standing Committee on Drought Relief.

Activities Intensified

Nine meetings were held this year. The meetings were concerned with a much intensified programme of drought relief. This followed introduction of further road transport rebate schemes for movement of starving stock to agistment and subsequent movement back to property of origin—because of acute and continuing shortage of railway vans and waggons for sheep and cattle. A rebate scheme on costs of road transport of fodder to the drought affected south coast was introduced. Also, greater use was made of the Rural Bank scheme which provides fodder loans to dairy companies to assist their suppliers.

The main drought relief schemes operating at 30th June, 1968, were:

Advances for Drought Relief.—In special circumstances a maximum of $12,000, at a special interest rate of 3 per cent, repayable over seven years, is loaned for "carry-on" purposes by the Rural Bank of N.S.W. to primary producers in necessitous circumstances because of the drought. Since inception of the scheme in November, 1965, loans amounting to $16,432,000 have been made to 3,527 eligible farmers.

Advances for Re-stocking.—This scheme is designed to assist primary producers who, being in necessitous circumstances because of the drought, are unable to get re-stocking finance through normal commercial channels or the Commonwealth Development Bank. Eighty-five farmers have received loans by the Rural Bank, amounting to $581,000, since this form of help started in April, 1966.

Dairy Fodder Advances.—The Rural Bank makes advances direct to dairy companies to finance fodder purchases on behalf of their suppliers who are in necessitous circumstances. A total of $2,674,000 has been advanced to eligible primary producers through this channel since its inception.

Road Transport Subsidies.—The rebate schemes previously in operation continued to apply to the road transport of stock and fodder within the Western Division. Rebates exceeding $104,000 were paid during 1967–68.

Because of insufficient rail trucks to meet the abnormal demand for stock movements in other areas, further schemes were introduced for rebates on road transport costs; for movement of stock from drought areas to agistment, on journeys which started on or after 21st February, 1968, and for return of stock from agistment to the property of origin, on journeys commencing on or after 13th May, 1968. The rebate is at the rate of 50 per cent of the cost, with a maximum rebate of 25 cents per vehicle per mile except that the maximum is 45 cents per vehicle per mile for approved 2-decker cattle transports. To date, rebates paid amount to $31,065.

Rail Freight Rebates.—Special emergency rail concessions were reintroduced as from 1st July, 1967, on the rail freighting of stock and fodder. These provided more liberal conditions than ordinarily apply under the Railway by-laws.

State Transport (Co-ordination) Act Charges.—As a drought relief measure, road co-ordination charges were waived on the cartage of hay to drought areas.

Declared Drought Areas

At 1st July, 1967, there were 20 Pastures Protection Board districts declared as drought areas. The total had risen to 30 in May, 1968, but at 30th June, 1968, had declined to 15 declared.

During the year the northern part of the State experienced a general recovery and the drought conditions moved southward. Conditions remained very dry until substantial rains fell during the autumn. The autumn rains broke the drought in all Eastern and Central Division areas except the south coast, southern tablelands and the Monaro, and, in the Western Division, Cobar.

AUSTRALIAN AGRICULTURAL COUNCIL AND STANDING COMMITTEE ON AGRICULTURE

Three meetings of the Australian Agricultural Council were held; the first in Darwin in July, 1967, and the others in Canberra in February and April, 1968. The Standing Committee on Agriculture met twice; in Darwin in July, 1967, and in Canberra in February, 1968. Numerous items important to agricultural organization were discussed.

ROYAL BOTANIC GARDENS AND GOVERNMENT DOMAIN TRUST

The Royal Botanic Gardens and Government Domain Trust met on three occasions. Action was taken for appointment of the Hon. G. R. Crawford, M.L.A., Minister for Agriculture, as a Trustee *vice* the former Minister for Agriculture, Mr W. A. Chaffey.

During the year the following matters were dealt with: re-modelling of the Domain Baths; leasing of kiosks in the Royal Botanic Gardens and Government Domain; erection of an electricity sub-station on a site adjoining the Naval Fuel Oil Tank Installation; amendments to Regulations for the Royal Botanic Gardens; a Public Liability Insurance Policy for the Royal Botanic Gardens; and construction of the Eastern Suburbs Railway.

FARRER MEMORIAL TRUST

Two ordinary meetings and the Annual Meeting of the Trust were held.

The Farrer Memorial Medal for 1968 was presented to Dr E. M. Hutton, Assistant Chief, Division of Tropical Pastures, Cunningham Laboratories, CSIRO, Brisbane, in the Great Hall of the University of Sydney at a function organized in association with the Australian Institute of Agricultural Science. There Dr Hutton delivered the 1969 Farrer Memorial Oration—"Australia's Pasture Legumes".

Arrangements have been made for presentation of the 1969 Farrer Memorial Medal to be staged in conjunction with the 1969 A.N.Z.A.A.S. Congress.

CENTENNIAL PARK SUPERVISORY COMMITTEE

This Committee was brought into being in May, 1964. On 30th June, 1968, its functions ceased.

It its 4 years the Committee has been instrumental in securing special votes to a total of $234,000 for restoration and developmental work in the Centennial and Queen's Parks. The Committee's plans and administration of the funds have achieved a great deal. This is visually obvious in those areas and there has been deserved widespread praise for the improvements.

In the Royal Botanic Gardens and National Herbarium section of this Report, the Director and Chief Botanist has devoted a section especially to the Committee (see page 128).

COMMITTEE OF ADVICE ON "THE INSTITUTE OF RURAL STUDIES"

Arising from a Ministerial decision to establish an Institute of Rural Studies in New South Wales, a Committee of Advice was organized. The Committee is required to consider and recommend concerning constitutional powers, authorities, objectives, duties, and functions that should be vested in The Institute of Rural Studies as a statutory body. The Institute of Rural Studies would be expected to be in due course a powerful and constructive force; *inter alia* in assisting the Agricultural Colleges to attain their tertiary education objectives.

A "DAIRY INDUSTRY ADVISORY COUNCIL"

In April, 1968, the Government set up a Dairy Industry Advisory Council with seven members; six from industry, primary and manufacturing, plus the Chief of the Division of Dairying. The Council was set up to:

investigate the structure of the dairy industry in N.S.W., with particular reference to the marketing of liquid whole milk and the production/marketing of manufactured dairy products;

advise on a proposal that a State Dairy Industry Authority be created, for regulation and supply of liquid whole milk and manufactured dairy products;

advise on the powers, duties, and functions of such Authority, with due regard for the role of other government instrumentalities and for any other Commonwealth or State marketing arrangements of a non-legislative character.

Some Notable Developments

CONCERNING LIVESTOCK INDUSTRIES

New Veterinary Laboratories

Construction of the District Veterinary Laboratory, Wollongbar, was completed and the Laboratory is functioning. This Laboratory to serve the north coast is the second decentralized laboratory of this type. The other is at Armidale.

Building of a new virology, serology, and amenities wing at the Veterinary Research Station, Glenfield, has also been started.

Tuberculosis

Four more Quarantine Areas, wherein the testing of all cattle is compulsory have been gazetted. There are now 80 such Areas. This year 845,516 cattle were tested and overall incidence of reactors was 0.09 per cent, the lowest percentage since the testing programme was started.

The Battey strain of tubercle bacillus had not previously been detected in N.S.W. livestock but this year was found causing a high level of infection in a herd of pigs. It was suspected also in three other piggeries, but not confirmed. Control proved difficult because affected pigs do not react well to any type of tuberculin. The Battey strain of the organism can cause in persons an infection which is difficult to treat.

Ephemeral Fever Outbreak

There was a State-wide outbreak in the period January to May, 1968. Previous outbreaks of comparable scale, had occurred in 1938 and 1956. This time the disease was in a less virulent form in inland parts of the State than was so in the 1938 and 1956 outbreaks, but in the more closely settled coastal districts the infection became highly virulent and caused severe loss of production in dairy herds.

Mastitis Control Programme Planned

Towards promoting a voluntary scheme aimed at control of mastitis in dairy cattle, a committee has been formed to plan the programme. The committee comprises representatives of the Divisions of Animal Industry, Dairying, Science Services, and Marketing and Agricultural Economics and the Biometrical Branch of this Department, and representatives also of the University of Sydney and the N.S.W. Milk Board. As an initial phase of the programme, demonstration and study projects are to be set up on some 40 farms.

Exotic Diseases

Plans for halting an outbreak of foot and mouth disease, should it ever occur in New South Wales were reviewed in the light of United Kingdom experience during the past year. Three veterinary officers from the N.S.W. Department of Agriculture spent three months in the U.K. assisting in the control of the major outbreak there and observing the methods.

Quarantine Vigilance

In administration of the Quarantine Act on behalf of the Commonwealth Government, considerable quantities of meat and other foods of animal origin, were detected in the baggage of passengers arriving by sea and air. Their importation is illegal and could be the means of introducing exotic livestock diseases. The problem of preventing this importation has grown in recent years with the increase in passenger arrivals, particularly by air. This year there were 409,611 arrivals by air compared with 294,688 in the previous year.

Cattle Tick Studies

At the Cattle Tick Research Station, Wollongbar, investigations into the life history of the cattle tick have shown that failure of the 1956–57 eradication campaign could not have been due to the length of tick-egg and larval survival. The studies have pointed to incomplete effectiveness of the dip chemical used at that time, as the most important factor.

Tick Fever, Low Incidence

Tick Fever again has been reduced to a very low level in N.S.W. In 10,669 complement fixation tests in 1967–68, seventeen carriers were discovered. Most of these were Queensland-bred cattle introduced to Legume district whilst this was outside the Tick Quarantine Area.

A separate and distinct outbreak, with 15 clinical cases, followed the presumed introduction of ticks on agricultural machinery. No carrier animals were found on this property, or neighbouring properties, and the outbreak appeared to have been stamped out immediately after its discovery.

Pesticide Residues

Research into incidence of pesticide residues in animal and plant products has been expanded. A special priority list of the more important products has been drawn up and the field and laboratory experiments are proceeding, towards minimizing any possible residues. The experiments with animals are concerned with dieldrin, DDT, carbaryl, malathion, and hexachlorobenzene, and with fruit are concerned with dodine, mercury, metacil, and thiabendazole.

North Coast Dairy Farm Feed-Year Assistance Scheme

The scheme's first 12 months ended on 30th September, 1967. In the 12 months there were 4,945 claims for assistance in providing pasture and crop seed, and fertilizer. The claims concerned 74,383 acres developed for feed-year purposes, as an effect of the scheme.

Progress returns for the 12 months from 1st October, 1967, indicated slowing down of applications compared to the first year of the scheme. Of the various reasons for the slowing down, the main has been unsatisfactory weather at the normal pasture sowing period. Regard for the influence of the scheme on dairy production has been consistently high. There have been many requests to extend the scheme beyond the Shires prescribed.

Whole-Farm Studies of Feed-Year Planning

Advances in butterfat production in the whole-farm research projects on the far north coast measured the success of feed-year planning. On chocolate soils, butterfat production has increased on one farm from 6,740 lb to 15,500 lb; on another from 10,060 lb to 13,300 lb. On alluvial Richmond River flats, production has increased from 6,390 lb on one farm, and from 7,081 lb on another, to 13,500 lb on each. Further production increases are expected when herd size is more noticeably increased than has so far been the case.

Drought Feeding and Wool Production

Studies at Trangie Agricultural Research Station have shown that wool production can be raised or lowered by the type of feed used to keep sheep alive under drought conditions. This introduces a new factor to influence feed selection.

Beef Cattle Lot-Feeding

Interest in lot-feeding has increased. Lot feeding is widely practised in America but so far has been adopted here on a very limited scale. Growth of this form of beef husbandry will be determined here by levels of financial returns.

More Pigs; Slaughtered at Lighter Weight

Pig population significantly increased and reached record levels, though pig meat production increased only slightly. Slaughtering at lighter weights for consumption as fresh pork prevented a greater increase in quantity of pig meat produced. Bacon production decreased accordingly but was sufficient to meet local demand.

Poultry Industry Trends

The trend towards larger flocks continued; also the trend to increased specialization in pullet rearing. Production of eggs and of chicken meat increased. Integration apparent in the meat chicken industry for some years past continued.

CONCERNING FIELD CROPS AND PASTURES

The Cotton Records

New South Wales raw cotton production was estimated as 114,000 bales (480 lb per bale), as against the 1965–66 record of 71,720 bales, and it virtually equalled the Australian spinners' requirements of raw cotton from Australian sources. The sown area was also a record; 51,200 acres (Namoi Valley, 44,500 acres; Macquarie Valley and Bourke, 5,500 acres; south-western irrigation areas, 1,200 acres). In the Macquarie Valley the sudden increase in acreage was due to rapid development of one property for cotton production; 4,700 acres planted.

Cotton Physiology Research Launched

A plant physiologist has been appointed, stationed at Narrabri Agricultural Research Station. This newly established position will provide a line of research not previously explored by the Division of Plant Industry.

Soybean Research

A soybean breeder has been appointed, stationed at Narrabri Agricultural Research Station, to develop soybean varieties suitable for irrigation culture in the northwest. The crop could have a big future there. Some excellent yields in 1967–68, from areas under irrigation, lend support.

The better yields reported from the northwest ranged from 40 to 56 bushels/acre, from trial commercial areas of up to 100 acres in extent. Yields from research plots were also at record high levels. In these plots a plot yield was as high as 59 bushels/acre, at Narrabri Agricultural Research Station.

Oils and Fats from Seed

A position of "oils and fats chemist" has been established and filled in the Division of Science Services. New equipment including the latest model gas liquid chromatograph has been installed for this specialist's study of oils and fats derived from oil seed crops (e.g., cottonseed, soybean, safflower, etc.). His studies will relate also to the use of the oils in commodities affecting dairy industry.

Rice Records Again

For the seventh successive year, N.S.W. rice growers produced a record crop, from a record sown acreage.

From the sown area of 76,000 acres (which, due to irrigation water supply problems, was less than the acreage initially intended for rice), 217,000 tons was the estimated production. The resultant yield average per acre would be virtually the same as the record 2.86 tons/acre averaged in 1966–67. In due course it could prove to be slightly higher. It would certainly have been higher but for the bad harvesting weather, in May and June.

Restrictions had to be placed on supply of irrigation water, as a result of drought but the effects were successfully alleviated by growers' co-operative efforts. The growers "pooled" a percentage of their irrigation water allocations, in order to "finish" as many rice crops as possible.

Soft-Wheat Quality Studies

A relatively quick and accurate method has been developed, to determine particle size in flour, for study of flours used in biscuit wheats. Biscuit flours are characterized by fine particle-size distributions. The developed method is used in conjunction with the centrifugal-air classification of flours.

Native Species and Natural Pasture Have Done Well

Pasture based on well-adapted native grass species has drawn higher regard during the recent dry years. Such pasture on partially pasture-improved properties has had a stabilizing effect and, grazed as a source of "energy", made important contributions to "survival".

This year, top-dressed pastures based on native perennial grasses, volunteer annual species and introduced white clover and naturalized clovers, again proved remarkably productive at Shannon Vale Nutrition Station. They yielded over 40 lb of wool/acre.

At Grafton, native *Glycine tomentella* P.8175 responded well to superphosphate, with a high percentage of winter-green pasture and useful seasonal production. This was in comparative trials with the "developed" Siratro variety.

These are but examples from a great deal of evidence accumulated, supporting the advice: "Don't despise the native species and natural pasture".

Pasture Species and Cultivars for the Hotter, Drier Inland

New pasture cultivars with heat tolerance and drought resistance won acclaim this year. These included Sirocco, a phalaris introduction by CSIRO from Morocco. It promises special value in the wheat belt inland, for ease of establishment and summer persistence.

Media, a perennial ryegrass, was excellent for summer resistance and drought resistance, and Berber cocksfoot handled the drought conditions at Temora better than any other cocksfoot variety.

More Nitrogen Used in Far North Coast Feed-Year Plans

Greater use of nitrogen on oats, and on kikuyu, in north coast feed-year planning have reflected in part the more ready lower price availability of nitrogen fertilizers. Other relevant factors were the serious *Amnemus* weevil problem in subterranean clover and subtropical legumes, and the serious root and stem rot problems in Golden Tares.

Some other contributing factors in the rapid increase of nitrogen use on the north coast are the resultant greater reliability of feed production to meet seasonal needs, and the stimulus of the Feed-Year Subsidy Scheme.

Forecasting Plague Locust Outbreaks

The availability of a full-time locust patrol officer, jointly financed by N.S.W., Victoria and South Australia, has enabled the develoment of procedures to estimate locust numbers at low densities and has greatly increased the accuracy of forecasting possible locust outbreaks in known breeding districts.

Experience gained with fixed winged aircraft in March, 1968, indicates that aerial surveying followed by ground surveys will provide information on locust infestations in sparsely settled areas.

CONCERNING FRUIT AND VEGETABLE CROPS

Promising New Apple Strains

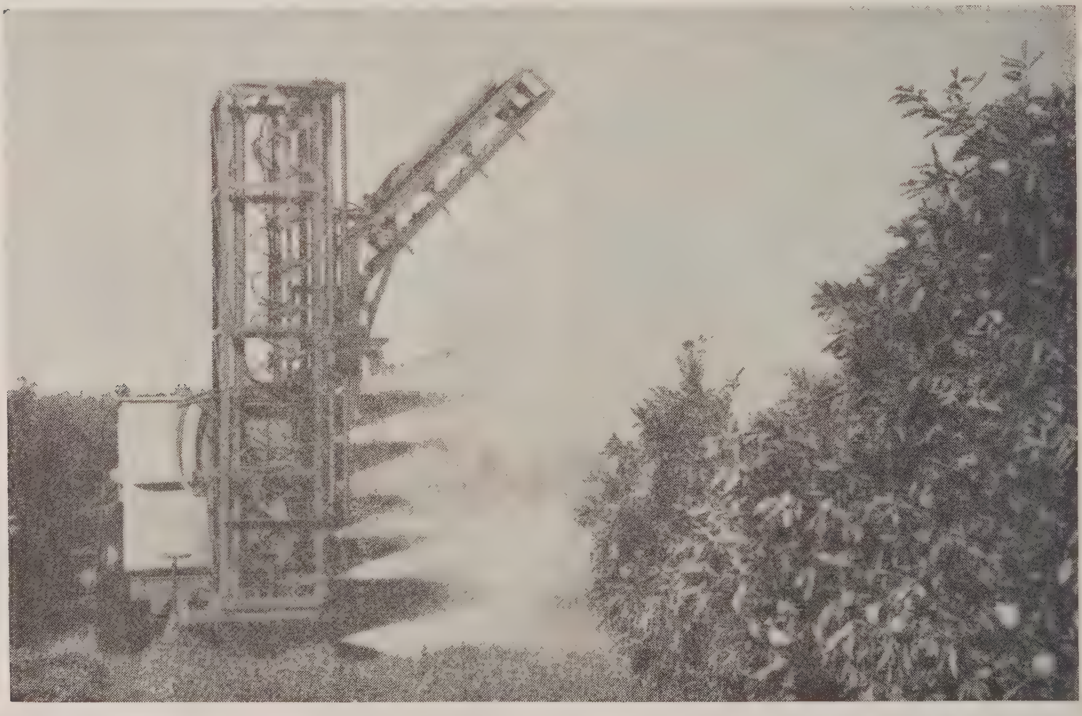
Promising American strains of Delicious apples and local selections planted out as district trials in 1960 are now providing excellent demonstrations for orchardists. Field days at the plots in the Orange and New England districts have given growers opportunities to make on-the-tree assessments and comparisons with standard varieties. All the imported Delicious strains have proved to be highly coloured and acceptable, although the colour of Starkrimson Delicious tends to be too deep.

Post-harvest Control of Stone Fruit Brown Rot

Thiabendazole effectiveness against *Sclerotinia fructicola* was confirmed. Various concentrations of the fungicide were studied. A research paper is being prepared. Six other chemicals were screened for effectiveness and one showed excellent control of *Sclerotinia fructicola* but none was effective again *Rhizopus sp.* Hot water dips were effective in controlling rotting but critical temperatures and duration of dip need closer evaluation to avoid fruit injury. Some residue data were obtained with thiabendazole on peaches and cherries.

Prune Plantings Survey at Young

From a comprehensive survey of prune plantings at Young a report has been submitted to various sections of the industry and a summary has been published in the May, 1968, issue of the Agricultural Gazette. The survey has yielded a sound basis for planning the future of the prune industry at Young and has raised greater awareness of the need for replantings if production is to be maintained there.



Oscillating Boom Sprayer in Citrus

A survey of citrus spraying equipment in the Gosford area showed the superiority of oscillating booms. Since the survey many growers on the central coast have acquired such equipment

Herbicide Management of Citrus

Herbicides' value in citrus soil management is being tested at Narara, Dareton and Yanco. At Dareton a totally bare surface by applying a particular herbicide in spring and in autumn is being compared with spring application plus a winter cover crop, *and* with normal clean cultivation plus a winter cover crop. The complete herbicide treatment comprising spring *and* autumn application has been outstanding. Associated with it were higher yields in the two crop years since the trial began, excellent tree health, no signs of herbicide injury, and no such soil effect as scouring of the bare surface or decreased water penetration.

Central Coast Spray Equipment Survey

For the Central Coast Agricultural Research and Extension Committee, citrus spraying equipment in the Gosford district was surveyed to define faults and recommend improvements. The survey clearly demonstrated the superiority of the oscillating boom type sprayer for citrus. Following the survey several types of oscillating booms have become available and many growers have purchased the new equipment.

Nematode Control in Bananas

A scheme operated jointly by the Division of Horticulture and the Banana Growers Federation to control nematodes in bananas was expanded this year. In this scheme banana planting material is heat treated under Departmental officers' supervision. The main heat treatment centre is in the Tweed district but two new centres have been established—at Coff's Harbour and in the Richmond River district. Thus, growers in all the main banana producing areas are now able to take advantage of this service. Plant numbers treated in 1967–68 were 206,500 at the Tweed centre (4,000 more than in the previous year), 48,000 at the Richmond River centre, and 40,000 at Coff's Harbour. The total represents approximately 50 per cent of all the 1967–68 banana plantings.

Banana Transport in Polyethylene Bags

Long distance transport trials have confirmed earlier work with polyethylene bags, wherein bananas responded well to this type of controlled atmosphere storage. Inclusion of an ethylene absorbent in the bag further delayed ripening and enabled fruit to be held in a hard green condition at ambient temperatures for several weeks.

Thiabendazole treatment of hands of fruit prior to packing was very effective against the development of *Gloeosporium* rots. Health authorities' approval to use thiabendazole in Australia has not yet been given but thiabendazole use on bananas was recently approved in the U.S.A.

Information Interchange on Banana Culture

Australia will be co-sponsor with the East-West Center of the University of Hawaii for a technical interchange on banana culture in 1969. The interchange over a 2 weeks period in New South Wales and Queensland banana growing areas will bring together banana culture specialists from South Pacific and Asian countries and special research personnel from countries outside the East-West Center boundaries. The funds will be provided by the East-West Center and the Commonweath and State Departments concerned.

Wine Grapes Pruning and Training

Experiments at the Viticultural Research Station, Griffith, have shown the value of T-trellis training for most varieties of wine grapes. Yields from the T-trellis system have been significantly higher than from the standard single-wire trellis. The increased yield has been shown to be not only a function of greater bud numbers but also of increased bud fruitfulness. Data from this series of experiments are being computer-analysed in several ways, to derive more information than would come from conventional analyses.

Irrigation of Drying Grapes

Results from a Lower Murray extension campaign to improve the efficiency, frequency and timing of irrigation for drying grapes have been outstanding. A whole-farm demonstration has been established. In this the greatly increased yields through lighter and more frequent irrigation have been clearly established; 100 per cent increases over three seasons. Arrangements made with the Water Conservation and Irrigation Commission have permitted variations to the irrigation roster in the district allowing for extra irrigations. Many growers are now taking advantage of the additional waterings.

Fruit Packaging and Market Presentation

The fruit packing instructor in co-operation with District officers conducted 21 fruit packing and grading demonstrations, presented 17 addresses at field days and was associated with packing schools held at Batlow, Willigobung, Bathurst and Richmond. He also assisted the staging and staffing of horticultural exhibits at the Orange National Field Day and at Gosford and Camden Agricultural Shows, and experienced ever increasing enquiries on fruit packaging. Particular emphasis has been on the grading, packing and marketing of stone fruits, bananas, apples, and tomatoes.

Fruit Specialists' Overseas Assignments/Studies

At the invitation of the Department of External Affairs and under the auspices of ASPTAP, Mr R. G. Kebby, Chief of the Division of Horticulture visited Western Samoa to investigate progress in the bunchy top control scheme to which Australia is contributing technical aid and equipment.

By invitation, Mr J. A. Seberry, Officer-in-Charge of Gosford Citrus Wastage Research Laboratory, delivered at the International Citrus Symposium at the University of California in March, 1968 a paper "Comparing various fungicides for control of post-harvest rots of Australian citrus." He then visited other citrus areas of the world to study research there on post-harvest citrus handling.

Fruit Research Officer, Mr K. J. Scott, by invitation of the N.Z. Department of Scientific and Industrial Research visited New Zealand to conduct studies on control of apple breakdown. He had organized also a long distanct banana transport trial from Australia to New Zealand using modified, controlled atmosphere storage principles and whilst in New Zealand was able to examine the outturn of this fruit. This was highly successful and stimulated a lot of scientific and trade personnel interest.

New Rockmelon Varieties for M.I.A.

The release of two new rockmelon varieties "Yanco Treat" and "Yanco Delight" bred at Yanco Agricultural College and Research Station is important for growers. Annual value of the crop in the Murrumbidgee Irrigation Areas is about $40,000. The new varieties are resistant to powdery mildew and fusarium wilt, diseases causing severe rockmelon losses in most seasons, and thereby represent a considerable technical achievement.

Manganese Toxicity; Soil Testing Service for North Coast Bean Growing

Research at Terranora and at Alstonville on the far north coast, into the manganese toxicity problem in winter beans, has shown that correction of soil acidity is important in overcoming the problem. This season, a soil testing service was instituted. Growers submitted soil samples from land intended to be sown to beans. After the soils were analyzed for manganese status, recommendations were made, where necessary, as to the rate of lime to be applied. The service proved popular with growers.

Potatoes for Crisping

Some recent emphasis in potato research has been on factors affecting crisping quality. With lifting of the Road Transport (Co-ordination) Tax, processors have shown interest in procuring their potato supplies in New South Wales instead of interstate. Investigations of varieties and cultural and storage methods have yielded data useful for growers who want to produce for the crisp-trade. The data indicate that good quality potatoes for crisping can be produced on the central tablelands. The cultural and post harvest practices needed have also been shown.

Spider Mites

Spider mites (Family Tetranychidae) have increased in economic importance because of the effect of wide-spectrum insecticides on biological balances. Extra attention is now being given to their distribution and host range. New species and new hosts and locality records have been determined in agricultural and horticultural crops.

Virus Identification Techniques

A Departmental plant pathologist has returned from 9 months at the University of California where he studied the latest methods in virus identification. He is to head up a team studying plant virology at Rydalmere, making use especially of the electron microscope to be installed there in the Division of Science Services.

New Plant Quarantine Station

A Quarantine Station is now being erected on land acquired by the Division of Science Services, Rydalmere. The value of the Station to the Commonwealth and the State will be enhanced by the ready access of the personnel to plant pathologists, to facilitate identification of possible diseases in imported plant material.

CONCERNING EXTENSION ORGANIZATION

In the Division of Plant Industry, Division of Horticulture and Division of Animal Industry sections of this Report, and in the Regional Supervisors' section, there are details of the several new District adviser positions established and filled in the past year.

Other significant happenings this year were the "Extension Policy and Design" workshop (4 days), subsequent formation of the "Extension Policy Committee" and "Extension Programme Co-ordination Committee", as standing intra-departmental committees, the Department's adoption of Extension Programming and work-planning as a requirement of each officer and unit in extension, and establishment of the new "Division of Extension Services". Detail of these stimuli to extension service and extension status is within the Division of Extension Services section of this Report.

Some Structural and Senior Staff Changes

NEW DIVISION OF EXTENSION SERVICES

By combining the administrative unit formerly known as "Regional Extension Services" with some former sections of the Division of Information Services, viz., the Agricultural Bureau, the Women's Extension Service and the Audio/Visual Aids Section, a new Division of Extension Services has been established. There is more detail later in this Report, respectively under "Division of Information Services" and "Division of Extension Services".

The new Division became effective in January, 1968.

Chief of the Division of Extension Services is Mr B. D. Ament; former Principal Extension Officer (Regional Services), who was also Acting Chief of Regional Extension Services after the retirement of Mr J. L. Green in August, 1967.

RE-LOCATION OF DROUGHT RELIEF ADMINISTRATION

Chairmanship of the Standing Committee on Drought Relief previously vested in the Chief of Regional Extension Services (Mr J. L. Green, retired) is now vested in the Chief of Research Stations Branch Mr N. K. Golding *and* an appropriate Drought Relief section comprising clerical and office assistance has been added to the Research Stations Branch establishment.

Also, Agricultural Engineer Mr I. L. Drever, in Research Stations Branch, has become the Bush Fires Committee member *vice* the former Chief of Regional Extension Services.

NATIONAL HERBARIUM NOT NOW A BRANCH OF THE DIVISION OF SCIENCE SERVICES

The National Herbarium formerly functioning as Botany Branch of the Division of Science Services is now a separate unit. Its administration combined with that of the Royal Botanic Gardens is as an autonomous unit under the control of Mr H. K. Mair, Director of the Royal Botanic Gardens and Chief Botanist—with status of a Divisional Chief.

SOME POSITIONAL NOMENCLATURE CHANGES

The positions of Senior Biologist, Senior Entomologist, Senior Chemist, Senior Botanist—respectively 2 I.C. in the Biology, Entomology, Chemistry, and former Botany Branch of Division of Science Services have been re-designated. The respective new designation is Deputy Chief Biologist, Deputy Entomologist, Deputy Chief Chemist, Deputy Chief Botanist.

FOUR CHIEFS RETIRE

The Chief of Research Administration, *Dr S. L. Macindoe,* the Chief of Regional Extension Services, *Mr J. L. Green,* the Chief Biometrician, *Mr F. C. McCleery,* and the Chief Biologist, Division of Science Services, *Mr W. S. Sutton,* retired during the year.

Between them they represented 183 years of service in the Department of Agriculture: Dr Macindoe, 43 years; Mr Green, 46 years; Mr McCleery, 47 years; Mr Sutton, 47 years. Of further interest, Dr Macindoe, Mr McCleery, and Mr Sutton had each joined the Department as a University Trainee in Agriculture, at University of Sydney, whilst Mr Green joined the Department directly on gaining his Diploma in Agriculture from Hawkesbury Agricultural College.

Dr Macindoe's career included a period as a plant breeder wherein he made a name as a wheat breeder in particular; two periods of overseas post-graduate study (1931 and 1939–41) during one of which he earned the Ph.D. degree of the University of Minnesota, U.S.A.; periods as Senior Research Officer, Principal Agronomist (Research) and Acting Deputy Chief in the Division of Plant Industry; a period from 1960 to 1967 as Chief Research Liaison Officer, in Central Administration, and in the final year of his service was designated Chief of Research Administration. Besides his personal success as a research worker Dr Macindoe has retired with widespread reputation for research organization, and for inspirational effect upon other research workers in many disciplines.

Mr J. L. Green's career included periods as Assistant Experimentalist; District Agricultural Instructor; Manager of Condobolin and Yanco Experiment Farms; Assistant and later Principal Agronomist (Extension) in the Division of Plant Industry; Executive Officer for Co-ordinated and Regional Extension Services, in Central Administration and, from 1957, Chief of Regional Extension Services. In the latter position he was also executive officer in Commonwealth Dairy Industry Extension and Agricultural Extension Grants matters; also Chairman of the Inter-Departmental Standing Committee on Drought Relief, and member of the Bush Fires and Flood Relief Committees. His establishment role in Regional Extension Services administration remains a monument.

Mr F. C. McCleery's initial work after graduating was Assistant Biologist, later Plant Pathologist, in the Biology Branch of the Department, a period wherein he built a reputation as citrus pathologist in particular. Throughout, however, his major interest was the application of mathematics to the planning and analysis of research and in 1940 he was seconded to the Division of Plant Industry as biometrician—available to assist research in all parts of the Department. In 1940 Mr McCleery was appointed to Central Administration in the newly established position of Biometrician and from there proceeded to staff and develop a Biometry Branch, as Senior Biometrician. The designation Chief Biometrician was conferred in July, 1960. Mr McCleery's role as a pioneer of the application of biometry to agricultural and allied research in this country remains beyond controversy.

Mr W. S. Sutton on graduating became an Assistant Biologist, later Bacteriologist, in the Biology Branch, with special reference to dairy products manufacture and quality. On return from Service in World War II, a period wherein his profession as a biologist was put to good use by the AIF and, by secondment, the Department of Supply and Shipping, he was appointed Senior Biologist (2 I.C.) in the Biology Branch. At this stage he re-directed his interest to plant pathology; vegetable pathology in particular. From June, 1960, until his retirement in 1968 Mr Sutton was Chief Biologist, Division of Science Services. Besides his personal successes as a scientist Mr Sutton made a leadership impact on the Biology Branch which has been critically important in the accelerated developmental era of the 1960's.

(Retirement of former Chief Entomologist Mr P. C. Hely on 7th July, 1967, was dealt with inadvertently in the previous Report—the Report of the Department for the year ended 30th June, 1967.)

THE REPLACEMENTS FOR RETIRED/PROMOTED SENIOR OFFICERS

The Chief of Research Administration position formerly held by Dr Macindoe is now designated Research Co-ordinator and held by Mr K. E. Hutton, former Executive Assistant to the Deputy Director-General (Research and Education).

The Chief of Regional Extension Services position formerly held by Mr J. L. Green does not now exist. His successor in that position, Mr B. D. Ament, is Chief of the new Division of Extension Services.

In the Chief Biometrician position vacated by Mr F. C. McCleery, Deputy Chief Mr H. C. Kirton is Acting Chief.

Mr W. S. Sutton's successor as Chief Biologist is his former Deputy, Dr Lilian Fraser.

Other senior positions vacated and refilled during the year were those of: Deputy Chief, Division of Dairying (Mr C. E. Chapman, retired) now held by Dr G. J. F. Smith; Senior Botanist (Dr J. M. Vickery, O.B.E., retired) now held by Mr L. A. S. Johnson with title of Deputy Chief Botanist; Executive Assistant to the Deputy Director-General (R.E.)

(Mr K. E. Hutton, promoted) now held by former Principal Agronomist (Miscellaneous Crops) Mr J. E. Jessup; and Principal Extension Officer (2 I.C. in Division of Extension Services) now held by former Special Extension Officer (Agricultural Bureau and Group Work) Mr J. J. Slater.

Finance—Summary

Consolidated Revenue Fund Expenditure and Receipts.—Expenditure from Consolidated Revenue Fund was $14,884,267. This included $2,429,925 for cattle tick control and $501,996 for the upkeep of the Royal Botanic Gardens, Centennial Park and Admirality House, part cost of which is recouped by the Commonwealth Government.

Details of expenditure by other Government Departments on behalf of the Department of Agriculture are shown in the Public Accounts, tabled in Parliament as an accompaniment to the Report of the Auditor General.

Receipts from all sources totalled $2,624,115 and are shown in detail later in this report (*Appendix* 1—"The Accounts of the Department of Agriculture—1967–68").

Capital Works. Capital works to the value of $472,347 were constructed from General Loan Funds—details are contained in *Appendix I*—"The Accounts of the Department of Agriculture—1967–68".

Trust Funds. The provision of funds by industries, semi-governmental bodies, Commonwealth Government grants, and specialized taxations continued to show upward trends. Substantial sections of the Department of Agriculture's research programmes have been financed by these means, and findings have been extended to primary producers and others with the help, also, of special grants (*vide* later paragraphs—"Commonwealth Extension Services Grant").

Receipts and expenditure from such grants and trusts are handled through the "Special Deposits Accounts" at the Treasury. Expenditure is regulated either by Act of Parliament or by such directions as may be given by the donor body, to whom the Department of Agriculture must account at the close of the financial year.

Some of the more important aspects of the operations on the Special Deposits Accounts are given in *Appendix I*—("The Accounts of the Department of Agriculture—1967–68").

Commonwealth Extension Services Grant

Prior to 1st July, 1967, this Department's extension services were assisted by two annual grants from the Commonwealth through the Department of Primary Industry. These were the Dairy Extension Grant and the Agricultural Extension Services Grant, but they are now one—the Commonwealth Extension Services Grant (C.E.S.G.). At the same time, the sum has increased. In 1966–67 the two grants to the N.S.W. Department of Agriculture aggregated $547,000. In 1967–68 the C.E.S.G. provided $752,100.

Throughout this report there are examples of ways the C.E.S.G. has enhanced the effectiveness of extension (and/or applied research) services of the various Divisions/Branches of the Department. In the Division of Extension Services section of the report there is a comprehensive listing of the general ways in which the funds are applied (*see* page 144).

Industry Funds for Research

Information in respect of these funds is provided by the Research Co-ordinator in the next segment of this report—"Research Administration/Co-ordination Office".

Research Administration/Co-ordination Office

SOME RELEVANT ADMINISTRATIVE POSITIONS AND CHANGES

After the retirement of Dr S. L. Macindoe, Chief of Research Administration, from the Department on 26th January, 1968, the designation of the vacant position was changed to Research Co-ordinator, with salary status equivalent to that of Deputy Chief of a Division. There was no change in duties.

Mr K. E. Hutton, previously Executive Assistant to the Deputy Director General (Research and Education), was appointed Research Co-ordinator on 7th March, 1968, and Mr J. E. Jessup, formerly Principal Agronomist (Miscellaneous Crops) in the Division of Plant Industry, was appointed to Mr Hutton's former position of Executive Assistant to the Deputy Director General (R.E.) on 24th June, 1968.

The Executive Assistant to the Deputy Director General (R.E.) is available to assist the Research Co-ordinator with the detailed administration of industry funds, allowing the Co-ordinator more opportunity for personal contact with the Department's research groups at the four Central Laboratories and 23 Regional Research Stations, Institutes, or Colleges.

Dr Macindoe's retirement and the resulting vacancy in one or other of the above positions from 26th January, 1968, to 24th June, 1968, coupled with the effects of vigorous research and education promotion policies, created some difficulties. However, maximum administration encouragement of the Department's research services will be possible again now.

RESEARCH REVIEW

Review Committee's Report on Agricultural Research Institute, Wagga Wagga. A Research Review Committee of five, including two eminent scientists from other organizations, examined and reported on the research programmes and facilities at the Agricultural Research Institute, Wagga Wagga.

The Committee was impressed with the work of the Institute; considered the Institute to be conducting regional research on an adequate scale, and contributing effectively to agricultural development and the solution of rural problems in the south.

Nineteen recommendations were made concerning the responsibilities of the Institute, its facilities, research programme, and organization, and the professional and ancillary staff, for consideration by the Director-General.

This was the first Research Review Committee, on a Departmental institution, wherein eminent scientists from other organizations have served by invitation. Professor C. M. Donald, from the Department of Agronomy, University of Adelaide, and Mr W. M. Willoughby, Officer-in-Charge, CSIRO Pastoral Research Laboratory, Armidale, were members.

Further Research Review Committees. Further Committees with a proportion of membership from appropriate external organizations will be set up to review other Research Stations of the Department.

OVERSEAS AND/OR POST-GRADUATE STUDIES BY RESEARCH STAFF

During the 12 months under report, forty officers were overseas for post-graduate studies or special purpose assignments, or to attend international congresses and conferences. This total comprised about 12 per cent of the research staff establishment of the Department. A further 12 per cent of the total research staff have been encouraged to register portion of their Departmental project or projects with an appropriate university in Australia, towards attaining a Master degree.

INDUSTRY AND COMMONWEALTH FUNDS FOR RESEARCH

A summary of the main research grants to the Department from various Industry and Commonwealth funds to support the Department's research programmes, is provided by the following tabulation. The past three years are included to provide comparisons. Additional minor grants came from industries for individual items during the period.

Source	1965-66	1966-67	1967-68	Totals
	$	$	$	$
Commonwealth Extension Services Grant	27,500	165,000	277,200	469,700
Wheat Industry Research Committee of New South Wales	84,760	47,130	85,980	217,870
Wheat Industry Research Council	37,252	47,302	97,696	182,250
Wheat Industry Stabilization Fund	66,874	11,667	85,493	164,034
Australian Meat Research Committee	98,884	80,910	152,705	332,499
Wool Research Trust Fund ..	61,036	107,288	110,699	279,023
Australian Wool Board Post-Graduate Scholarships	550	11,974	10,871	23,395
Australian Dairy Produce Board	103,778	67,158	65.998	236,934
Banana Research Advisory Committee	6,976	5,700	10,300	22,976
Honey Research Advisory Committee	2,900	4,800	2,800	10,500
Tobacco Industry Trust Account	58,100	67,630	36,410	162,140
Australian Apple and Pear Board	..	13,600	8,200	21,800
Spray Residues Research (Commonwealth Grant)	10,600	11,600	11,100	33,300
Totals $	559,210	641,759	955,452	2,156,421

That tabulation implies in part the confidence of the various industries in the Department's research services capacity to assist development of the respective industry. Equally it implies the Department's responsibility to continue pursuing vigorous research programmes, particularly in the applied field; and the essentiality of research and extension services working closely together for the common objective.

Some new research projects were approved, and supported wholly or in part by grants from various industry and Commonwealth funds in 1967–68:

Commonwealth Extension Services Grant Funds

This fund was directed in part towards improvement of research facilities at many of the Department's central laboratories and Regional research centres. Approximately $100,000 was allocated to develop an electron microscopy unit at the Division of Science Services, Rydalmere.

Other major allocations, totalling more than $70,000, were to the Division of Science Services, the Agricultural Research Institute, Wagga, and the Agricultural Research Stations at Wollongbar, Narrabri, Trangie and Orange, for additional research equipment to expand research programmes in chemistry and biology, cereals, pasture and animal nutrition, cotton breeding and potato quality.

Australian Meat Research Committee

No new beef project was supported from this source in 1967–68, but the following mutton and lamb projects were supported:

Glenfield Veterinary Research Station Project.—The Biological study of drought and supplementary feeding of sheep, $50,000.

Trangie Agricultural Research Station Project.—Sheep fertility service, $26,565.

Marketing and Agricultural Economics Division Project.—Regional economic studies on mutton and lamb production, $3,350.

Wheat Industry Research Council

The following grants were received from this source for new projects in 1967–68:

Wagga Agricultural Research Institute Project.—Importation of Norwegian drill and Austrian autoheader, $8,000.

Tamworth Agricultural Research Station Projects.—Australian National Wheat Variety Collection, $15,000; Improvement of grazing lucerne varieties for wheat belt soils, and testing of *Phalaris* strains, $14,500; controlled environment facilities, $10,500; and a Pathology glasshouse, $12,000.

INTRA-DEPARTMENTAL NEW PROJECTS REGISTERED IN 1967–68

Thirteen new intra-Departmental project approvals in 1967–68 were as follow:

Division of Plant Industry

Natural pasture research—Shannon Vale, superphosphate level x stocking rate; grazing trial to examine effect of improved nutrition on the breeding performance of beef cattle on the Clarence River basin's finer-textured soils; evaluation of natural pasture in terms of plant and animal products; and examination of a forage sorghum under dryland conditions, in terms of livestock performance.

Division of Science Services

Entomology Branch.—Ecological and biological studies on *Amnemus* weevils; Cerambycid borers in citrus trees; and Lucerne bud mite (*Aceria medicaginis*).

Division of Dairying

Solids-not-fat investigations; wet brewers grain or other feeds *versus* other roughages.

Division of Marketing and Agricultural Economics

Income uncertainty of vegetable production under irrigation in N.S.W., with particular reference to Mudgee district.

Division of Horticulture

The ontogenetic development of the banana in N.S.W. conditions; apple rootstocks for hedgerow planting; winter chilling records, deciduous fruit orchards; and cherry decline on Mahaleb rootstocks.

Automatic Data Processing (A.D.P.) Section

A.D.P. systems are in advanced stages of development for two new projects: Beef Cattle Performance Recording, and Citrus Leaf Analysis.

The Beef Cattle Project.—The computer is being programmed to examine calf weights at birth, weaning and yearling; to adjust weights for various factors; and to rate calves in the herd, based on weight gain performance. Sires and dams are similarly rated, on progeny performance. Reports from this project will provide information whereon the breeder can base his breeding and culling programmes.

The Citrus Leaf Analysis Project.—Field and laboratory data relating to leaf samples collected in a number of test orchards over a 5-year period will be examined by the computer to determine the nutritional status of the trees from which the samples were taken. This will enable assessment of effects of previously recommended rates of fertilizer dressings and nutrient sprays, and provide information to assist the making of fertilizer recommendations for citrus growers throughout the State.

Dairy Herd Recording.—This A.D.P. system has been further amended and expanded; to simplfy data collection and preparation, and to expedite the printing of reports and statistical tables.

Potential New A.D.P. Projects.—Three potential projects have been approved for exploratory study. These relate to:

- Recording, indexing and catalogue-listing of some 20,000 specimens in the Plant Pathology Herbarium Collection, Division of Science Services.
- Processing of data from the tile drainage experiment at Griffith Vitcultural Research Station.
- Introduction of a Pilot Soil Testing Service for Wheat, to operate from the Agricultural Research Institute, Wagga.

The exploratory study of the Plant Pathology Herbarium Collection is in progress.

Officers' A.D.P. Training.—Ten officers attended introductory courses of training in A.D.P. Another was trained in FORTRAN programming. Talks on A.D.P. and computers and their use in agriculture were given to groups of officers at Wollongbar, Rydalmere, and Richmond.

RESEARCH STATIONS BRANCH

SCOPE

This is a service branch, not responsible for the research subject-matters but for the following:

- Control, administration, and development of the Agricultural Research Stations;
- Farm-operations supervision at Hawkesbury Agricultural College, Wagga Agricultural College, and Glenfield Veterinary Research Station;
- Supervision of purchase and maintenance of plant, machinery, and vehicles at the Agricultural Research Stations, Hawkesbury and Wagga Agricultural Colleges, Glenfield Veterinary Research Station, Wagga Agricultural Research Institute, the Plant Industry research centre at Berry, the Royal Botanic Gardens, and elsewhere as may be requested by other sections;
- Co-ordination and control of the Department's capital works programme;
- Supervision of the Architects Branch, through which the Capital Works programme is implemented;
- Maintenance of the Western Division Public Watering Places and control of associated staff;
- Development and conduct of the Agricultural Machinery Advisory Service and an applied research programme.

ADMINISTRATION OF EMERGENCY DROUGHT RELIEF SCHEME ADDED

In March, 1968, the administration of the emergency drought relief schemes under Departmental control was transferred to the Research Stations Branch and several new forms of emergency relief were instituted. These comprised schemes for rebate of part of the cost of road transport of stock from drought stricken areas to agistment, from first to subsequent agistment and the return of stock from agistment to the property of origin, as well as a rebate scheme for costs involved in transporting fodder by road to the far south coast.

Property Improvement at the Institutions

ACQUISITION OF LAND

No new Station was established but additional areas of land were acquired for existing institutions.

An additional 100 acres was acquired as an extension of Wollongbar Agricultural Research Station. Another 138 acres of land adjoining Wagga Agricultural College was purchased, for expansion of activities of the Wagga Agricultural Research Institute.

Representations have been made to Department of Lands to take over 800 acres of Grafton Common and the adjoining Travelling Stock Reserve, to increase the research potential of Grafton Agricultural Research Station. Also, representations have been made to lease 224 acres of grazing land near the Station, to expedite the beef cattle research programme and pasture research work there.

For Narrabri Agricultural Research Station negotiations are under way for an approximate additional 400 acres to facilitate the cotton, summer crops and oil crops research.

For Tamworth Agricultural Research Station application has been made to acquire 230 acres from the Travelling Stock Reserve of Breeza, to be developed as an out-station for wheat research on black soil plains country under irrigation.

CAPITAL WORKS

Capital works included structures for research, storage, education and housing.

The Capital Works expenditures from funds derived from the General Loan Account and the Commonwealth States Grant (Technical Training) and (Advanced Education) Acts totalled almost $800,000. Roundly $472,000 of this was from the General Loan Account.

Major works undertaken were completion of buildings comprising the District Veterinary Laboratory complex at Wollongbar and initial stages of construction of the Laboratory and Conference Room at Glenfield Veterinary Research Station.

The buildings comprising the District Veterinary Laboratory were completed but some equipment has still to be obtained to make them fully operative. Expenditure on this project has so far totalled $147,118 and is expected to approximate $170,000 when the equipment is supplied. The Laboratory was officially opened by the Minister on 8th May, 1968.

The other major work commenced was the Laboratory and Conference Room at Glenfield Veterinary Research Station. This project is estimated to cost some $517,000 when fully equipped. Expenditure on it this year was almost $88,000. The building should be completed by February, 1969.

General Loan Account Expenditures for Particular Works Completed

Place	Work	Expenditure, 1967-68	Totals
		$	$
Dareton Research Station ..	Extensions to irrigation and drainage.	10,051	24,396
Dareton Research Station ..	Additional offices........	15,381	43,163
Narrabri Research Station	Plant Breeders Shed (cotton).	39,577	44,578
Wagga Research Institute ..	Agronomy Barn	7,655	10,855
Wollongbar Research Station	District Veterinary Laboratory.	146,938	147,118

General Loan Account Expenditures on Works in Progress

Place	Work	Expenditure, 1967-68
		$
Rydalmere	Plant Quarantine Station	9,000
Hawkesbury Agricultural College	School of Dairy Tech. Research Laboratory.	67,488
Glenfield Veterinary Research Station.	Veterinary Research Station and Conference Room.	87,868
Glenfield Veterinary Research Station.	Steam Raising Plant and Autoclaves.	22,940
Mis. works ($1,449) and State contribution to Advanced Educ. projects.	....	65.449

States Grants (Technical Training) Programme

From these grants, a total of $863,240 was provided in the triennium from 1st July, 1965, to 30th June, 1968. In the programme the following Capital Works, except the Animal Husbandry Unit at Hawkesbury Agricultural College, were virtually completed this year. Work on the Animal Husbandry Unit is at an advanced stage.

Place	Work	Expenditure, 1967-68	Totals
		$	$
Hawkesbury Agricultural College.	Renovations to Science Block*.	109,123	189,666
Wagga Agricultural College	Extensions to Graham Block and Lecture Rooms*.	193,979	267,769
Wagga Agricultural College	Engineering and Farm Machinery Demonstration Unit.	33,028	63,387
Various	Previous years expenditure	..	374,704
Hawkesbury Agricultural College.	Animal Husbandry Unit	18,076	..
Miscellaneous expenditure..	Purchase of Equipment and Minor Adjustments.	8,719	..
Total expenditure during the year	.... $	362,925	..

* The final cost of this project has yet to be obtained from Public Works Department.

States Grants (Advanced Education) Programme

This programme provides for expenditure of $1,422,000 over a triennium; the 1967–68–69 calendar years. Expenditure so far has been only on preliminary planning, site levelling and minor buildings and has totalled $33,074.

RESEARCH STATION IMPROVEMENTS; OTHER THAN CAPITAL WORKS PROGRAMME

Apart from the Captial Works programme, numerous improvements were effected on Research Stations.

Fencing. The expanding pasture and livestock research programmes required considerable subdivisional fencing. This was particularly so at Trangie, Condobolin, Grafton, Orange, Tamworth, and Yanco.

Boundary fencing had to be renewed at Wollongbar because of acquisition of more land. At Seven Hills Poultry Research Station 32 chains of security-type fencing were erected.

In all, 2 miles of boundary and 9 miles of subdivision fencing were erected on the 18 Research Stations this year, at a total expenditure of $15,000.

Roads and Road Repairs. Improvements to internal roads by grading, surfacing, and maintenance of surface conditions continued, particularly at Alstonville, Condobolin, Leeton, and Yanco.

At Grafton, a problem section of laneway adjacent to the dairy was reformed; treated with a new commercial roadpacker preparation. If this is successful it would be applied to similar areas at other Stations.

At Yanco Agricultural College and Research Station, besides repair and patching of bitumen surfaces, there was extensive installation of kerbing and guttering.

Aesthetic Improvements. Aesthetic improvements were considerable, particularly at Yanco. There the flower gardens were extended, including rose plantings.

At Leeton the gardens were maintained at a high standard. At Condobolin, Dareton, and Trangie additional shade, shelter, and ornamental trees and shrubs were planted. At Condobolin, the tree-planting programme, started in 1963, has increased to some 4 miles of trees and the 1967–68 plantings comprised a three-row section totalling 35 chains.

Flood Mitigation and Earthworks. A sum of $1,000 was spent on construction of levee banks to control flooding of a pasture area at Duck Creek Substation of Wollongbar Agricultural Research Station.

At Tamworth Station, Soil Conservation Service plant was hired at a cost of over $500 for construction and realignment of contour banks for soil erosion control.

Land Clearing. Condobolin, Grafton, Narara, Narrabri, and Orange combined to expend nearly $4,000 on land-clearing operations on 100 acres in preparation for future research projects.

Machinery and Equipment Purchases

Consolidated Revenue Funds expenditure for purchase of items of equipment, apparatus, and machinery totalled $75,000. Items purchased for general and research use included tractors, rotary hoes, scarifiers, mowers, hay-baler and elevator, combines, welder, hammer mill, grain auger, and rotary slashers, to the approximate value of $40,000.

Units purchased specifically for research included soil grinders, laboratory ovens, fleece weighing tables, chemical balances, low-volume sprayer, anhydrous ammonia rig, power-driven soil sampler, incubators, spectrophotometer, paper electrophoresis equipment, column electrophoresis unit, automatic fraction collector, air conditioner, etc., to the approximate value of $35,000.

In addition, considerable plant for research was purchased from Industry Funds and Commonwealth Extension Service Grants. For example, Wheat Industry Funds to a total of $20,000 were expended at Trangie for purchase of a 5-ton low loader prime mover truck, utility, and a self-propelled wheat header.

Commonwealth Extension Service Grant Funds provided such items as motor vehicles, pressure chamber, balances, scales, refrigeration equipment, crop grinder, centrifuge, colorimeter, soil sterilizer, etc., for use of research officers at Research Stations. Further, a large number of equipment items are on order with funds frim this grant and will be supplied early in the 1968–69 financial year. These items include a $6,000 Allcrop Header for Narrabri, a $10,000 Controlled Plant Growth Chamber for Alstonville, and a $6,000 Soil Temperature Control Unit for Wollongbar.

Assistance was provided to the Colleges, Wagga Wagga Agricultural Research Institute, and Glenfield Veterinary Research Station in the selection and purchase of machinery, apparatus, and equipment.

The total number of tractors of various types located on Research Stations and other Departmental institutions is 176, and the total number of trailers, mobile scales, registered harvesters, caravans, etc., is 150. Virtually all the above units are registered.

Provision of Stores, Minor Plant, Plant Repairs, etc.

Stores, minor plant and equipment, repairs to plant and equipment, and other services were provided, to a total of $180,000—a slightly higher expenditure than in the previous year.

Development of Water Supplies and Irrigation

Trangie. Approval was granted in December, 1967, for the Department to participate at Trangie Agricultural Research Station in irrigation development associated with the Trangie-Nevertire Irrigation Scheme. This scheme provides for use of waters from Burrendong Dam. The main supply channel runs through the Research Station and commands soils there considered highly suitable for irrigation.

Irrigation research for this part of the State would require allocation of about 500 acres for irrigation development at the Station. This would enable the Station to become an irrigation research centre, but would also make it self-supporting in terms of lucerne hay and other types of fodder production to feed animals in the livestock research programmes.

Dareton. Two hundred and fifty chains of tile drainage and 25 chains of sealed mains were installed at Dareton Horticultural Research Station to extend the irrigation facilities.

Alstonville. Irrigation facilities were also extended at this Tropical Fruits Research Station.

Glenfield. Action to provide a more permanent irrigation water supply for Glenfield Veterinary Research Station is proceeding, by installation of a weir in the adjacent Bunburry Carran Creek. At present the stream flow is inadequate. It does not provide enough water for the 27 acres under licence for irrigation.

Condobolin. At this Agricultural Research Station installation of an electric pumping unit has been started, including automatic switchgear and accessories to replace a diesel-powered pumping unit on the domestic and stock water supply system, at a cost of $3,800.

Others. Improvements and extensions were also effected to the water supply of 12 other Research Stations and Yanco Agricultural College and Research Station, at a cost of $13,500.

Two new sub-artesian bores were sunk at Trangie Agricultural Research Station at a cost of $4,300, and $1,600 was expended on excavation of five new ground tanks at this station.

Grain Storage Facilities

New grain silos were erected at Temora, Wollongbar, Leeton, Tamworth, and Trangie Agricultural Research Stations, increasing the storage capacity by 32,000 bushels. Together with the 20,000-bushel bulk grain storage shed recently erected at Condobolin, the grain storage capacity on Research Stations has been increased by 100 per cent.

More Assistants at Research Stations

Reflecting the increasing research programmes at Research Stations, the field assistant establishment was increased by 13 positions, affecting 10 Research Stations. Also, an additional laboratory assistant position was established at Tamworth, and an additional farmhand position was approved for each of four Research Stations.

Maintenance and Operational Activities at the Institutions

Maintenance

Major maintenance work at the Research Stations, etc., comprised renovation of the Hospital Block at Yanco Agricultural College and Research Station to provide additional office space, renovation of the toilet block at Hawkesbury Agricultural College, renovation and painting of the main office buildings at Glen Innes and Wollongbar Agricultural Research Stations, painting of the administration and laboratory building at Trangie Agricultural Research Station, erection of poultry houses at Glenfield, and repairs to roadworks and the painting of 17 cottages at various Research Stations.

In all, $69,800 was expended on maintenance work.

Seed Production

Seed production was poor compared to more favourable seasons but sufficient cereal seed was produced to meet the institutions' crop production needs and no large-scale purchases were necessary.

Orange Agricultural Research Station continued to produce "Elite" potato seed for distribution, but the programme suffered in the poor growing conditions.

Fodder Production and Utilization

Conditions, compared with the previous year, were unfavourable for production of much grain and hay but Research Stations were able to hold enough fodder to meet the needs. There are still adequate stocks, notwithstanding the unfavourable seasonal conditions.

Fodder stocks in reserve at 30th June, 1968, comprised 52,700 bushels of grain, valued at $59,500, and 1,887 tons of hay, valued at $47,780; total value $107,280.

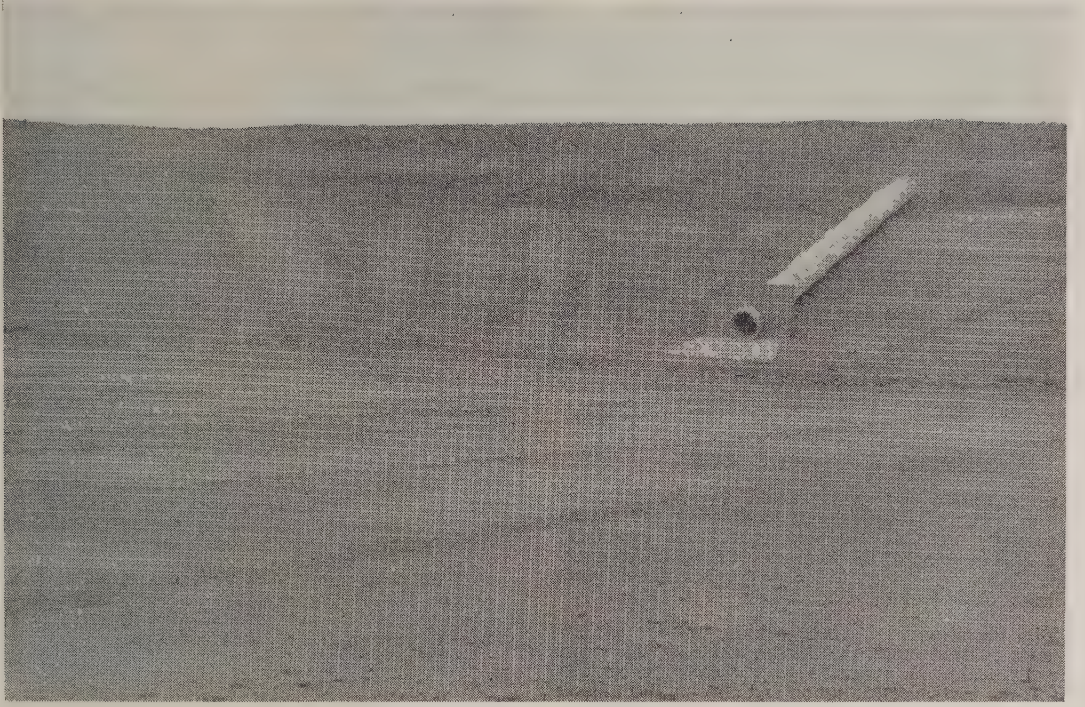
Fodder transferred from producing to consuming stations for livestock research comprised 42,700 bushels of grain, valued at $48,630, and 1,236 tons of hay, valued at $30,000; total value $78,630.

An excellent break in the seasonal conditions occurred in May, 1968. It provided highly satisfactory early development of the Research Stations' cereal sowings. With a normal seasonal pattern the grain and hay yields should be sufficient to replenish stocks to the pre-drought level and also to fill the extra storage provided this year. Winter cereal sowings at Research Stations to the end of June, 1968, comprised 1,000 acres wheat, 1,550 acres oats, 30 acres barley and 5 acres ryecorn.

Livestock

Sheep.—In the period May to December, 1967, the drought made necessary a transfer of sheep from Trangie, Condobolin, Temora, and Cowra Agricultural Research Stations to Stations which had had better seasonal conditions. The largest single transfer was 2,000 merino lambs from Trangie to Glen Innes. All aged sheep superfluous to research needs were sold.

Beef Cattle.—The Angus herd of 167 had to be moved from Trangie Agricultural Research Station. Half were agisted at Orange and the rest at Leeton Agricultural Research Station. Calving and subsequent mating of the cows have taken place at Orange and Leeton.



Re-conditioned Stock Watering Place, Western Division

Some $383,535 has been spent on Western Division Watering Places over the past 3 years; re-conditioning the storage and silt tanks, bores, windmills, troughing and reticulations. This year's expenditure was $96,535, on 70 of the 300 Watering Places. Increased road transport of stock has reduced need of new works. The programme is to re-condition and maintain existing facilities

Public Watering Places in the Western Division

The extensive maintenance programme undertaken at Western Division Public Watering Places over the preceding 2 years was continued. The Consolidated Revenue Fund expenditure in maintenance and improvement of some 70 Public Watering Places was $96,535 this year.

For improvements and maintenance works an aggregate of $383,535 has now been expended on Public Watering Places during the last 3 years. Objectives have been the reconditioning of storage and silt tanks, bores, windmills, stock watering troughing and reticulation at the 300 Public Watering Places. This year work was undertaken in each Pastures Protection District in Western Division. The work included: desilting of ground tanks; earth works maintenance; sinking bores; supply and installation of stock watering troughing; concrete storage tanks and windmills; together with needed machinery maintenance.

Increased use of road transport to move stock has reduced the need for new works, so the programme is to keep existing facilities in good working order. However, Palgamurtie Tank had to be replaced when the supply from the well became unreliable, and a 20,000-cubic yard tank was excavated at a cost of $7,600. Also, two sheep and cattle loading yards and ramp are under construction at Enngonia Bore (Bourke P.P. District) and Packsaddle Tank (Milparinka P.P. District) at roundly $2,500 each.

General

MOTOR VEHICLES

Administrative work in connection with supply of motor vehicles throughout the Department has been transferred to the Research Stations Branch.

Thirty-six additional motor vehicles of various types were supplied and forty-five existing vehicles were replaced in 1967–68. The Department's motor vehicle fleet (utilities, sedans, station sedans, trucks, jeeps, Land Rovers, and Mini Mokes) now totals 254.

Following the successful testing of "Mini Mokes", a light, front-wheel-drive runabout vehicle, four were provided for location on Research Stations and one each for Hawkesbury Agricultural College and the Royal Botanic Gardens.

DROUGHT

The transfer of administration of the emergency drought relief schemes to the Research Stations Branch threw heavy burdens on staff despite addition of a senior clerical officer, a junior clerical officer, a shorthandwriter/typist and an office assistant. Even with this additional staff, temporary assistance was required from a relatively senior clerical officer and shorthandwriter/typists and office assistants.

Transfer of this administration necessitated appointment of the Chief of Research Stations Branch, Mr N. K. Golding, as Chairman of the Standing Committee on Drought Relief (replacing Mr B. D. Ament, the Chief, Division of Extension Services) and his appointment also to the Standing Committee on Unemployment Drought Relief.

The Chief, Research Stations was a member of a three-man delegation to the Commonwealth Treasury to put forward State's views on the extent of Commonwealth assistance for emergency drought relief measures.

During April and May, 1968, the drought broke in the major portion of the area affected. But some of the south coast and southern tablelands, and isolated pockets in the far west and on the northern tablelands were still involved.

The bad seasonal conditions affected many of the Research Stations. Most of the stations suffered to some extent, even where irrigation was available, because the water was insufficient at critical periods.

At Dareton Horticultural Research Station the high salt content of the water drawn from the Murray River was a matter of concern. Reference is made elsewhere to the movement of stock and the hand-feeding of stock at Trangie, Condobolin, Temora, and Cowra Research Stations.

During May and June, 1968, monies were obtained from the Unemployment Drought Relief Committee to employ on Research Stations persons in districts affected by the drought. The sum of $15,000 was provided for this and was expended on six Research Stations, and the Yanco Agricultural College and Research Station and Wagga Agricultural College. Twenty-five persons were employed, for varying periods. The additional labour, obtained through the Commonwealth Employment Service, was used to erect fencing, clear land, prune fruit trees, repair roads, kerb and gutter, and to assist in construction of amenities at Yanco Agricultural College and Research Station.

Agricultural Engineer's Section

OVERSEAS STUDY TOUR BY ENGINEER

The Agricultural Engineer, Mr J. G. Drever, visited agricultural engineering centres in the U.S.A., Canada, and United Kingdom. His comprehensive report on agricultural engineering research, extension and education in the countries visited, and observations on many other aspects of agricultural engineering, is now in distribution.

Of particular importance were his observations on institutional tractor and farm machinery testing; farm safety; standardization of farm machinery; mechanization of cereal industries, the fruit and vegetable industries, narrow-row cotton production; combating droughts in Canada; mechanization of fodder storage, feeding, manure disposal and housing in poultry, beef cattle, pig and dairy industries; irrigation and farm drainage; and production of equipment for research workers.

Action is in hand towards implementation of important recommendations made by the Agricultural Engineer.

MACHINERY EXTENSION WORK

The main extension service conducted by the Research Stations Branch concerns agricultural engineering and machinery. Especially for this purpose, agricultural machinery officers are sited in some of the Regions, working under direction of the respective Regional Supervisor in common with other extension officers of the Department.

Apart from the activities of those officers, and the agricultural engineers at head office, the Station and Farm managers were generally active in extension work related to projects proceeding at the particular institution and also the institution's more general activities.

The Agricultural Engineering Section was extremely active in the extension field; through personal consultations, radio, television, films and the press, also through articles in the *Agricultural Gazette of N.S.W.* and the Central Coast and Murrumbidgee Irrigation Area newsletters, and by providing data sheets and drawings related to agricultural machinery for rice harvesting and for wheat storage.

The personnel also were active in field days and demonstrations, and at short schools and at meetings promoted by the Agricultural Bureau, Rural Youth Clubs and other farmer organizations.

One measure of the extent of these activities is that the seven agricultural machinery officers totalled 1,249 consultation visits to farms.

Arising from the increasing range of machinery used in agriculture one officer reported handling enquiries on not less than 62 differently classified types of farm machinery.

For radio, 300 separate tapes were recorded. For television, 19 shows were telecast live and a short television film was produced.

The agricultural machinery officers participated in 58 field days and farm machinery demonstrations. The largest was the National Field Days project at Orange, where attendances aggregated 25,000 and there were 196 exhibitors and 420 separate comparative demonstrations of machinery in the four days. The Regional agricultural machinery officers at Orange played a big part in the organization of the National and was also publicity officer.

The first *major* machinery field days in the North Coast Region were held this year; organized by the Regional agricultural machinery officer. The day at Casino drew more than 2,000 people and the other, at Macksville, drew about 600.

MACHINERY INVESTIGATIONAL AND RESEARCH ACTIVITIES

The work undertaken, in particular by the assistant agricultural engineer, included: investigation and modification of oscillating boom sprayers for use in citrus orchards; a study of equipment required for controlled atmospheres storage of fruit; production of a cheap generator, at about 10 per cent of the cost of available commercial units; a study of banana washing, waxing and packaging, to provide a basis for design of a suitable unit for general use by banana growers (in co-operation with the Regional agricultural machinery officer); and the design, including specification and detailed drawings, of sophisticated controlled soil temperature equipment for use by research agronomists at Wollongbar (in co-operation with the Plant Inspector).

The assistant agricultural engineer also investigated ***Phalaris*** seed harvesting, sub-tropical pasture equipment (in co-operation with the Agricultural Machinery Officer), and designed a treatment plant for the Citrus Wastage Research Laboratory at Gosford.

Agricultural machinery officers in the Regions investigated problems in grain handling, electric fencing, pasture sowing equipment, rice harvesting, the mechanical handling of canning fruit, and hard facing of tynes.

The agricultural machinery officer stationed at Gunnedah investigated farm grain storage systems and bulk handling of wheat. Also he has developed in co-operation with a local farmer a new type of grain screen, for which a provisional patent is to be taken out. In field tests this is functioning satisfactorily.

Concerning Safety in Rural Industries

General

The agricultural engineer served on the Executive Advisory Committee for Safety in Rural Industries. All of the meetings were attended, by either the engineer or the assistant.

Work on safety regulations for the timber industry and for agricultural field machinery is now well advanced. Work on safety regulations for agricultural stationary machinery and for rural poisonings and diseases is continuing.

Talks on farm safety were delivered at ten tractor schools at various places. Farm safety posters prepared by the Department of Labour and Industry were featured in the *Agricultural Gazette of N.S.W.* during the year.

National Seminar on Safety in Rural Industries

The agricultural engineer represented the Standing Committee on Agriculture in a committee working on follow-up actions from the National Seminar on Safety in Rural Industries held in June, 1967. A report of the work of this committee has been sent to all State Departments of Agriculture.

Inter-Departmental Committee on Occupational Safety and Health

The agricultural engineer acted as the Department of Agriculture's Safety Liaison Officer. In this capacity he represented at this year's two meetings of the Inter-Departmental Committee and also attended two schools, on safety, arranged by the committee.

Accident statistics for the Department were compiled for 1967 with a view to initiating follow-up actions to reduce incidence.

All field officers, and workers on Research Stations, were given copies of the Department of Labour and Industry's booklet on "Safety Policy Rules and Instructions" and "Safety in Rural Work". A directive on "Occupational Safety and Occupational Health" from the Director-General was also distributed to all Departmental staff.

Machinery Advice to Other Departments and Organizations

Assistance in assessment and purchase of various types of equipment and agricultural machinery was given to various Departments including Government Stores and Health.

Department of Education was helped in preparing the syllabus and examination in Farm Mechanics. The Technical Education Department's Technical Education District Committee, Leeton, was helped in connection with the syllabus and equipment needs for teaching Farm Mechanization.

The Commonwealth Department of Primary Industry, the Commonwealth Statistician, the Taxation Office, the Department of Customs and Excise and the Department of Trade and Industry were helped in connection with assessment, acquisition and use of agricultural machinery.

Advice was tendered to the Rural Bank, the Bank of New South Wales, the Commonwealth Development Bank and other financial institutions in relation to costs and types of agricultural machinery.

Close liaison with machinery industry was maintained by the agricultural machinery officers and the agricultural engineers, with mutual benefit and for the good of the farming community. Farmers have gained through the assistance given to various firms and organizations in developing new machinery.

Examples are: a new type of bale pick-up machine which subsequently gained the New Implement Award at the Australian National Machinery Field Day at Orange; two types of cotton harvesters for harvesting narrow-row and broadcast cotton (in association with the CSIRO and the Irrigation Research and Extension Committee at Griffith); a new type of grain cleaner, referred to previously; and a new type of *Phalaris* seed harvester.

Bushfires Committee

Following a re-allocation of duties formerly performed by the Chief of Division of Extension Services the agricultural engineer was appointed to represent the Department on the Bushfires Committee, because much of the work of this committee now is concerned with bushfire fighting machinery. Three meetings of the committee and one school were attended by the agricultural engineer.

DIVISION OF PLANT INDUSTRY

General

STAFF

Increased Numbers

Division of Plant Industry began in 1967–68 with 159 established positions and 14 of these were vacant. It ended 1967–68 with 169 positions, 158 occupied and 11 vacant. Nine of the vacancies were research positions. The net gains were 10 in establishment and 13 in number of staff employed.

The net gain of 13 in staff employed resulted from recruitment of 22 new officers (18 university graduates and four college diplomates), plus four transfers from other sections of the Department and one officer returned from National Service Training; less 11 resignations (8 graduates and 3 diplomates), 2 intra-Departmental secondments, and 1 retirement.

At 30th June, 1968, the Division had 25 positions in Head Office and 144 in rural areas. Of the 144 rural positions, 73 are research and 71 are extension positions.

Whilst 11 new positions were created (9 in research and 2 in extension) the position of tobacco breeder at Glen Innes Agricultural Research Station was deleted. Thus the net gain of 10.

Of the 11 new positions, 4 were financed from Consolidated Revenue funds, 3 from Commonwealth Extension Services Grant funds, 2 from the Tobacco Industry Trust Account, 1 from N.S.W. Wheat Research Committee funds, and 1 from Australian Wool Board funds.

Industry funds have in recent years been helpful in aiding expansion of research in certain directions, but some difficulties have arisen from contraction of these funds through drought and the requests by fund administrators that salaries originally charged to them be transferred to Consolidated Revenue funds.

Commonwealth Extension Services Grant funds also have helped to facilitate research in the past few years, but assistance from this source has gradually become harder to secure because a large proportion of the grant total has been committed to continuing long-term expensive projects—such as through salaries.

Post-Graduate Study and Training

For Doctorates. At 30th June, 1968, six officers were engaged in Ph.D. work at Australian and U.S.A. universities.

For Masterates. Also, six officers were on secondment to the CSIRO Division of Plant Industry, Canberra, engaged in co-operative research and training. Each of these is registered with the University of Sydney as a masterate student. Eleven other officers also were continuing external studies towards a master's degree. Two officers gained masterates this year.

Overseas Study Tours

Principal Agronomist (*Cereals*). The report by the Principal Agronomist (Cereals) on his overseas investigations in 1966 into winter cereals, was received in printed form in July, 1967, and widely distributed. The study tour included U.S.A., Canada, England, France, Belgium, and Holland. Main subjects covered in this report were cereal culture; trends of research; breeding, testing, naming, registration, release, and recommendation; means to encourage the growing of desired varieties; and cereal pure seed production.

Special Agronomist (*Fodder Conservation*). The Special Agronomist (Fodder Conservation) returned in September, 1967, from a study tour of U.S.A., Canada, and Britain. His report is being printed for appropriate circulation.

District Agronomist Positions

Vacancies. At the start of 1967–68 there were 45 established District Agronomist positions. Eleven of these were vacant at the time, including three newly established Districts. During the year another three became vacant; two of these because of resignations and one by transfer of the officer to another position.

Of that total of 14 vacancies, 8 were filled by trained officers during the first eight months of the year, and at the close arrangements were well in hand to fill 4 more.

Training for District Positions. The in-service training scheme to provide officers to fill vacant and newly created District positions enabled 8 of the vacancies earlier mentioned to be staffed by well trained agronomists. It also facilitates firm planning to meet the ever increasing demand by primary producers for extension service.

ACTIVITIES OF DISTRICT AGRONOMISTS

Work-time Distribution. The District Agronomists' work-average was 225 days, comprising, on average, 56 days on office work, 17 in attending conferences and schools, and 152 on field work—including field days, crop and pasture investigations, land settlement matters, seed certification and registered seed areas, farm competitions, agricultural shows, individual farm visits.

Group and Mass Media. District Agronomists serviced 187 field days (aggregate attendance 9,458) and 225 meetings (attendance 6,465), delivered 848 radio broadcasts, made 58 TV appearances, and provided 587 press articles.

By comparison with the previous year the number of field days and of meetings were greater. Aggregate attendance at field days was lower but at meetings was higher. The lower field day attendance aggregate has been attributed to the difficult drought conditions.

Extension Programme Planning

District Agronomists were called upon to state the main agricultural problems upon which they were concentrating their extension efforts, and these became their extension targets for the year. Generally good progress was made, in all districts, in fulfilling the stated aims.

During the year the Extension Workshop conducted by the Department led to a general requirement of Extension Programme Planning. This is now being implemented in all Districts. Each District Agronomist has selected from one to three objectives and has prepared a co-ordinated plan of work designed to assure the most efficient use of his time and available resources towards achieving the set objectives.

Regional Conferences

Two Regional Research and Extension Conferences were held by the Division, one at Glen Innes and the other at Yanco.

PLANT EXCHANGES

There was a total of 934 seed introductions from overseas sources and 535 samples were sent to overseas research workers.

Services to Land Settlement

The Principal and Assistant Principal Agronomists (Extension) continued to assist the Closer Settlement Advisory Board and to co-ordinate the contributions of other officers to land settlement work. A number of meetings were attended. Some concerned proposals for dairy farm rehabilitation, and others the review of home maintenance standards in light of economic changes.

Services to Irrigation

More Irrigation Research. The vast increase in irrigation in New South Wales has emphasized need to pay ever-increasing attention to best use of the limited water resources. Aware of this, the Department has had created this year a second irrigation research agronomist position, at Leeton Agricultural Research Station. The first irrigation research agronomist was stationed during 1967–68 at the CSIRO Irrigation Research Station, Griffith, for training in irrigation research methods.

FARM WATER SUPPLIES

Farm Water Supplies Act. Applications to pump from rivers, dams and bores continued to increase.

Landholder applications for finance to purchase and install pumping plants, where the advances under the Farm Water Supplies Act would be greater than $4,000 and therefore required Department of Agriculture inspection/report totalled 150; similar to the total inspected in the previous year.

The interest in establishing or developing farm water supplies was general throughout most of the State. Almost all district agronomists reported this aspect of agricultural development.

Bore Developments. Interest in use of underground water resources has increased, further speeded by continuation of drought conditions, particularly in the south.

In the north most of the underground water being developed is of good quality for irrigation. But in the south many bores are saline. The drought conditions in the south have tended to condition farmers to use for irrigation purposes water too high in salinity.

District agronomists have had difficulty convincing farmers that the use of doubtful waters, particularly in heavier soils, can quickly bring about soil sterility.

COMMITTEES ON WATER RESOURCES, IRRIGATION, FLOOD, AND DRAINAGE MATTERS

The Principal Agronomist (Irrigation) represented the Department in the following Committees: Board of Enquiry Under Water Act; Hunter Valley Conservation Trust; Hunter Valley Flood Mitigation Act, 1956—Assessment Board; Blowering Dam Investigations Committee; Water Research Foundation (State Committee); Standards Association—Spray Irrigation Sub-Committee; Gwydir River—Construction of Major Dam; and Committee of Advice on Flood Mitigation.

Weeds Work

NOXIOUS PLANT ADMINISTRATION

Positive action to bring about more activity in noxious plant control by councils, and a reduction in the number of noxious plants proclaimed noxious in some areas, have been features of the year.

The Noxious Plants Advisory Committee, under the chairmanship of the Principal Agronomist (Weeds), continued as main co-ordinating link between local government bodies, the Department of Local Government, and Department of Agriculture.

The Committee held meetings this year at Scone and Mudgee as part of its policy of seeing the problems and meeting the people who deal with them. Also, representatives of the Committee visited Inverell, Windsor, and a number of South Coast and Tableland shires for contact with local councils on noxious plant matters. On the South Coast, several councils agreed to review their policies with a view to enforcing noxious plant control on private lands.

To improve noxious plant control, the Committee arranged the Scone meeting of councils to discuss the formation of a noxious plants county council. Unfortunately, this received little support.

Following a recommendation by the Committee, the Local Government Boundaries Commission held an inquiry at Inverell into the Committee's proposal that a weeds county council be constituted to comprise the Shires of Ashford, Bingara, Macintyre, and Yallaroi, and the Municipality of Inverell.

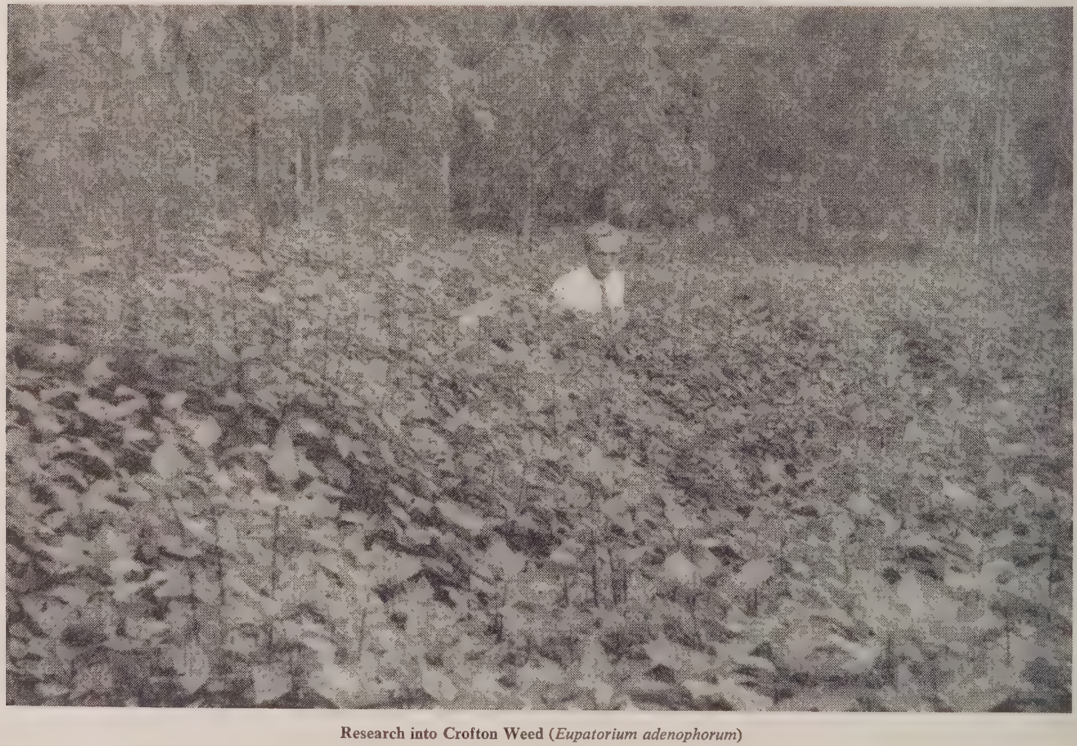
The Hawkesbury River County Council, following discussions with members of the Committee, agreed that the total of about 30 weeds proclaimed noxious in its area be reduced to 12. This new list has since been gazetted. It represents a trend toward proclaiming noxious only those weeds likely to spread, to cause real loss, and for which the control can be enforced with subsequent community benefit.

The State Government again made a $400,000 grant to assist councils' noxious plant control programmes. Most of the $400,000 was allocated $ for $ for control of the more dangerous noxious plants on council and public lands and to employ weed inspectors. Direct grants were also made for control of certain of these weeds on vacant Crown land.

The cost of councils' programmes supported by the Noxious Plants Advisory Committee again showed an increase, compared with the preceding year. Actually, it became necessary to reduce support to some councils and, in particular, withdraw support for equipment purchase.

The earlier created position of senior field officer (weeds) was filled. The officer has established liaison with councils on noxious plant matters, particularly for field investigation of problems of concern to the Noxious Plants Advisory Committee. He has investigated serrated tussock and blackberries in the Blaxland Shire and blackberries in the Nundle Shire.

A school for council weeds officers was held at Tamworth.



Research into Crofton Weed (*Eupatorium adenophorum*)

Weeds research now includes detailed study of the ecology of Crofton Weed, a serious woody weed on the north coast. Thorough knowledge of environmental conditions that affect the weed will enhance the control prospects

SERVICES TO RESEARCH AND EXTENSION IN WEED CONTROL

Weed Control Workbook Supplemented. This year two supplements comprising about 18 sheets have been distributed to research and extension officers of the Department.

Plant Identification and Control Sheet. This, designed and distributed last year, has been extensively used by field officers. It has greatly facilitated the identification services provided by the Chief Botanist and the subsequent advice to field officers concerning control measures. In light of accumulating experience of the Sheet, some minor amendments have been made. The Sheet as revised has been submitted for printing.

Weeds Society Conference. Agronomists of the Weeds Section of the Division presented papers to and were largely responsible for organization of the first conference of the Weeds Society of New South Wales. This was held at the University of New South Wales.

Symposium on Wild Oat Research. This was arranged and held at the Tamworth Agricultural Research Station. Delegates attended from all wheatgrowing States and from companies involved in production of appropriate herbicides. The symposium successfully promoted exchange of information between research workers and highlighted the needs as regards further investigations into particular aspects of the problem.

DEVELOPMENTS IN THE WEED SITUATION

One of the most significant developments in application of weed science is the increasing farmer adoption of pastures based on subtropical grasses and legumes to control the more dangerous weeds of the North Coast, including Crofton weed (*Eupatorium adenophorum*), lantana (*Lantana camara*), and bracken fern (*Pteridium aquilinum*). At the same time, however, wild tobacco tree (*Solanum auriculatum*) has become a pest in these pasture mixtures, at least in the early stages.

In more temperate areas, sheep's sorrel (*Acetosella vulgaris*) has increased, particularly on the southwestern slopes and southern and northern tablelands, and no easy answer to this is apparent.

In cereal crops, wild oats (*Avena* spp.) and skeleton weed (*Chondrilla juncea*) remain easily the most important weeds. However, as noted last year, fumitory (*Fumaria* spp.), spiny emex (*Emex australis*), black bindweed (*polygonum convolvulus*), and yellow burr weed (*Amsinckia* sp.) have been more prevalent and are being treated by the newer herbicides; bromoxynil, linuron, prometryne, and picloram. The perenniel weeds, sour sob (*Oxalis pes-caprae*) and silver-leaved nightshade (*Solanum elaeagnifolium*) while not covering large areas, are spreading and causing concern.

In western grazing areas, problems causing concern are in particular galvanized burr (*Bassia birchii*) and Darling pea (*Swainsonia* sp.). These seem beyond the graziers' control resources. Rapid and widespread build-up of both weeds followed the drought-reduction of natural pastures. Woody weeds are also of concern there.

Several cases of significant progress in the control of noxious plants are of interest.

The Upper Macquarie County Council has organized the aerial spraying of serrated tussock (*Nassella trichotoma*) and has advised that infestations in the Oberon Shire have been greatly reduced, in fact to the stage where there will be no area large enough to warrant aerial spraying in 12 months' time. In the Gunning Shire, also, intensive action has sharply reduced the infestations.

In the north, groundsel bush (*Baccharis halimifolia*) has now been almost eliminated in Crown lands in Tweed Shire and eradication has started on private holdings.

Along the Hunter Valley, Indian hemp (*Cannabis sativa*) infestations have been sharply reduced to isolated plants or patches. Disturbance of river bank soils brought seeds to the surface and helped maintain the weed.

WEEDS RESEARCH

Bathurst Agricultural Research Station

Serrated Tussock.—Work in the Bathurst and southern tablelands districts to control serrated tussock (*Nassella trichotoma*) continued. But, as the research officer concerned is on secondment to the University of New England on a Wool Board Research Funds Scholarship, only project maintenance work was undertaken.

Chemical Ploughing.—Work started in the previous year, indicating the useful role of herbicides in improved pasture establishment, was continued. A well attended field day was held to interest landholders in this work.

Herbicides and Apples.—Tolerance of apples to several herbicides continued. So far there has been no evidence of damage other than the chlorosis which followed 2,2–DPA application in the first year. It would seem that 2,2–DPA may affect apples in dry years if used in excess of recommended rates.

Hawkesbury Agricultural College Weeds Research

Heavy rains ruined a number of trials situated on the College and valuable work was lost. Also, the research agronomist resigned. This affected the research programme. A new appointment was made toward the end of 1967–68.

Weeds in Carrots.—This year it was possible to make a new recommendation in respect of herbicides for use in autumn-sown carrots. A recommendation for spring-sown carrots is pending.

Weeds in Potatoes.—The programme for weed control in potatoes was continued, in plots at Orange, using the most promising herbicides previously tested. The trial is not complete and as yet it is not possible to make recommendations.

Surfactants.—Studies of the use of surfactants on the efficiency of herbicides were commenced.

Inter-plant Competition.—A series of trials has been planned, to study inter-plant competition.

Tamworth Agricultural Research Station Weeds Research

Wild Oats.—The Tamworth work continued to be mainly concerned with wild oats, but some was done also on skeleton weed.

Because of great interest in post-emergence control of wild oats and the critical nature of barban application, studies involving this chemical continued.

Further wheat varieties were examined for reaction to barban. Most of the common recommended varieties have now been tested. Festiguay and Olympic show the least tolerance. It is stressed, however, that in no case has there been wheat damage where the recommendations as to barban rate and volume and the stage of wheat growth were carefully followed.

Rate by volume studies indicate the possibility of desired more economic control of wild oats by barban. Further work is needed before a recommendation is made.

Other wild oat studies have concerned oat strains, and also the effect of wild oat numbers on wheat yield. Only one season's work has been done so far.

Skeleton Weed.—Portion of the northwestern wheat belt has been mapped to show the distribution of skeleton weed. This was done in co-operation with local government staff and will be basic for more detailed work.

Yanco College and Research Station Weeds Research

The work has concentrated on weeds in rice and cotton. Some work on weed control in onions has been started.

Weeds in Rice.—Further trials this year indicated substantial gains in rice yield by barnyard grass control. The following tabulation records the yields in trials on a farmer's property.

Treatment (lb a.i./acre)	*Yield (tons/acre)*
No herbicide	2.53
3 lb molinate pre-emergence	3.41
5 lb molinate pre-emergence	3.53
3 lb molinate post-emergence	3.61
5 lb molinate post-emergence	3.50
3 lb propanil post-emergence	3.31

Yield per acre increased by about 1 ton where weeds were effectively controlled. Molinate seemed more effective as a post-emergence treatment. Increasing the rate beyond 3 lb/acre did not improve the result.

Other rice work comprised trials to investigate broad-leaved weeds of rice, and trials to determine rice tolerance to acrolein.

Weeds in Cotton.—Trials were continued to measure the usefulness of a number of herbicides in cotton.

There was also work on methods of incorporating the substituted urea group of herbicides. Papers and articles reporting on this work are now in preparation.

Wollongbar Agricultural Research Station Weeds Research

Available data on the local environment were studied. Some errors in existing rainfall isohyets for the Richmond-Tweed were found and will be corrected.

Crofton Weed.—A survey of Crofton weed infestations was completed and submitted for computer analysis. This analysis has been designed to relate natural and environmental conditions to the occurrence and growth of the weed.

Field trials to find the most suitable methods of killing the weed prior to pastures establishment included slashing, slashing and ripping, and chemical spraying.

Herbicides tested on Crofton weed include those presently in use or recommended by chemical companies. Some show a degree of usefulness. 2,4–D appears to be the cheapest method of control, and with the least soil residue. Further studies are required to determine the most effective chemical to use as a preliminary to pasture establishment.

The research agronomist is collating as a master's thesis most of his work over the last 2 years.

Narrabri Agricultural Research Station Weeds Research

Weeds in Cotton.—Significant work on use of herbicides in cotton was undertaken at Narrabri. All the presently used commercial herbicides were tested.

A weeds incorporation trial using available and commonly used farm implements was also undertaken.

Occurrence of weeds in cotton and the costs of weed control in cotton were surveyed. The analyses are proceeding.

A booklet on weed control in cotton in the Namoi Valley is in preparation by the Station agronomists.

Comparisons of Herbicides.—Four herbicides, viz., fenuron, picloram, bromacil and a proprietary mixture were tested. This was at Parkes. Results so far indicate fenuron and bromacil as the most useful. A firm recommendation on rates is not yet possible.

Weeds Section—Liaison with Chemical Industry

Officers of the Weeds Section continued close liaison with industry. There were joint inspections of trials, discussion of results and some joint projects. The liaison undoubtedly assisted the section's preparation of extension matter.

Several new herbicides were registered this year. Among these were propachlor, bensulide, endothal, cacodylic acid and norea. As well as new chemicals registered, several new uses for others were approved.

Cereals Work

COMMITTEES AND CONFERENCES

The Principal Agronomist (Cereals) was active in numerous committees. These included the N.S.W. Departmental Wheat Executive, N.S.W. Standing Advisory Committee on Wheat, N.S.W. F.A.Q. Standards Committee, State Wheat Improvement Committee, Research Programme Review Committee (Wheat Plant Nutrition). As Secretary of the N.S.W. Advisory Committee on Wheat Production and Marketing he handled considerable enquiries. He attended also the Wheat Uniform Quality Testing Committee as an observer.

WHEAT

The Results of a Record Wheat Acreage

In 1967–68 the sown wheat acreage in New South Wales was a record. At the end of July, 1967, a very heavy crop appeared likely to follow the record 1966–67 production of 202,501,000 bushels. But seasonal prospects then started to deteriorate, especially in southern and western sections. Practically no useful rain fell in the critical months, September/October.

Of the estimated 8,400,000 acres in the record area sown for all purposes about 1,500,00 acres failed for grain. Even so, an estimated 89,000,000 bushels of grain was harvested; the fifth from highest harvest on record. The estimated yield average was 10.7 bushels/acre sown for grain.

A feature of the harvest was excellent grain quality and appearance. Protein content overall was the highest ever. The grain also had good bushel weight and low foreign matter content.

Deliveries in New South Wales to the Wheat Board, as at 28th May, 1968, totalled 72,538,000 bushels; comprising 71,713,000 bushels in bulk (over 98 per cent) and 825,000 bushels bagged. Of the total, 54,272,000 bushels was f.a.q., 14,637,000 bushels received a premium, and 3,129,000 bushels were classed as off-grade.

Also, about 4,025,000 bushels of New South Wales wheat was delivered to the Wheat Board in Victoria from southern stations operated by the Victorian Railways.

The remainder of the harvest, about 12,437,000 bushels (as estimated at 28th May, 1968) had been held back on farms for seed, feed, or later delivery to the Wheat Board.

Premium Wheats

Local premium payments by millers to 5th February, 1967, totalled $159,503, on 1,845,804 bushels; as against the previous year's $557,922 on 3,614,174 bushels.

Soft wheat varieties (1,030,053 bushels) comprised most of the local premium purchases for the 1967–68 crop.

Normally most of the wheat sold locally at a premium would be hard varieties. This time the hard variety local premiums were for only 717,959 bushels, the lowest quantity for many years part.

Of the durum wheat variety Dural, 97,792 bushels commanded a premium.

The premium average paid for hard bread wheat varieties was 10.82c per bushel (19.66c in 1966); for soft varieties, 4.59c. (4.57c in 1966); and for the durum wheat Dural, 35.16c (34.36c in 1966).

Highest premium average for a variety was for Dural (35.16c). For the hard bread wheat varieties the premium averages were respectively, Festival 19.20c, Gala 14.73, Mendos 12.47c, Koda 12.15c, and Festiguay 11.69c.

Gauged by quantity accepted at a local premium the most popular hard bread wheat varieties were Mendos 31.7 per cent, Gamenya 17.5 per cent, Gamut 16.5 per cent, and Falcon 14.8 per cent. These four totalled over 80 per cent of the premium deliveries of hard bread wheat.

Of the soft variety deliveries at a local premium, the two varieties Pinnacle (90.9 per cent), and Heron (5.2 per cent) accounted for 96 per cent of the total.

Premiums average for soft was considerably lower than those for hard bread and durum wheats.

In addition to the aforementioned premium wheat quantities, 12.5 million bushels tested for protein was received at selected points for eventual local or overseas sales.

F.A.Q. Standards

For the 1967–68 harvest three standards were declared by the New South Wales F.A.Q. Standards Committee: "prime hard", "northern f.a.q." and "southern-western f.a.q.". "Prime hard" (mainly from northern New South Wales) was declared at 62½ lb/bushel Schopper weight. "Northern f.a.q." (related to wheat to be exported from Newcastle) was declared at 64½ lb/bushel. "Southern-western f.a.q." (related to wheat to be exported from Sydney) was declared at 64 lb/bushel. The official Schopper scale used normally records weights 1–1½ lb higher than on the Franklin Chondrometer.

Of interest, "prime hard" in the previous season (1966–67) was declared at 63 lb Schopper weight (protein 13.8 per cent on a 13.5 per cent moisture basis); "northern f.a.q." at 63 lb (wheat protein 12.1 per cent); and "southern-western f.a.q." at 62¾ lb (wheat protein 10.9 per cent). In 1966–67, standards were set also for "northern off-grade" (59½ lb) and "southern-western off-grade" (59 lb).

The "prime hard" from the 1967–68 harvest was uniformly very bright (dark) in appearance and somewhat smaller grain than the "northern f.a.q.". Its protein content when finally determined will be very high. The "northern f.a.q." was fairly uniformly hard in appearance and of obviously high protein content. The "southern-western f.a.q." was quite mixed for colour, with dominant soft colour, but larger grain than the "northern". This was surprising, in view of the seasons' prevailing poor finishing conditions in southern and western New South Wales. Protein content of the southern-western sample is expected to be determined the highest on record.

Wild oats was more apparent in the southern-western than in the northern samples. This was unusual.

Wheat Variety Popularities

Variety statistics for the 1966–67 season are the latest available. The four leading varieties of the 1965–66 season—Heron, Falcon, Olympic, and Gamenya—maintained their positions. Between them they occupied almost 60 per cent of the total area sown. Mendos and Festiguay, released only three years previously, totalled about 15 per cent of the area. Their quick rise in popularity was because of their reliable resistance to stem rust.

Wheat Variety Recommendations

Two new varieties were added to recommendations for 1968 sowings—Robin in central and southern areas and Timgalen in northern areas.

Robin, a back-crossed derivative from Heron, was developed at the Agricultural Research Institute, Wagga. It would yield better than Heron in most seasons, is resistant to some strains of stem rust (resistance similar to Gamenya) and is several days earlier in maturity. It has soft grain, with milling and baking quality similar to Heron.

Timgalen was developed by the University of Sydney from Aguilera x (Kenya x Marroqui x Supremo) x Gabo x Winglen. It is resistant to stem rust, leaf rust and flag smut and its grain is of excellent milling and baking quality. It matures three to four days earlier than Gamenya.

In respect of wheat variety recommendations an innovation was made in 1967 and extended in 1968. Besides the detailed recommendations published each year for the State, special leaflets were prepared for the Southern Agricultural Region, for 1967 and 1968 sowings. This service was extended to cover also the South Western and Mid Western Regions for 1968 sowings.

Winter Wheats

Lack of effective early rains for 1967 resulted in less acreage of winter wheats than in the previous year, when the Departmental varieties Winglen and Windebri were sown on 88,000 acres, mainly in the north.

In some northern localities where early rain was enough for establishment, winter wheat was sown, mainly for grazing. Grain yields were below normal because of the dry early spring.

Durum Wheats

All durum wheat grown in New South Wales was of the Departmental variety Dural.

Production of Dural in the north declined, mainly due to the dry conditions. About 100,00 bushels was harvested as against 200,000 in 1966–67.

All grain, except that sown for seed, sold at premium prices. Premiums totalling $44,390 were paid by local millers on 97,792 bushels of Dural; a premium average of 36.16c/bushel. A higher premium average was paid for Dural than for any other wheat in 1967–68.

Some new dwarf durums evolved in the northern wheat breeding programme centred at Tamworth were preliminary yield tested in 1967. They did not come up to expectations because of the unfavourable season.

Wheat Quality

Chemistry Branch co-operated in the quality assessment of new wheat varieties being tested on Research Stations and co-operator farms. About 700 samples were supplied for testing. Also, uniform quality testing of a number of promising crossbreds was done by collaborating laboratories.

Following tests on the wheat crossbred N.B. Javelin 115 the State Wheat Improvement Committee agreed to proceed with application for naming and registration of this crossbred. Depending on the final yield and quality test information one or more other lines may be considered for release.

The cereal specialist judged the bench characters of wheat in the open classes at the 1968 Royal Easter Show. Ninety-eight samples were entered, compared with 55 the previous year.

Best samples in the main classes were very high standard. Quality on the bench was generally the best for some years past. Top bushel weight was 68 lb, for two Spica entries. Next best bushel weight was for a sample of Heron weighing 67½ lb.

The best varieties on the bench in respective class were Falcon, Festiguay, and Heron, in that order (all bred by the N.S.W. Department of Agriculture) and the Queensland variety Spica. Some samples of the University of Sydney variety Gamut also performed well.

Entries, in order of variety popularity, were Heron (18), Gamut (17), Falcon (15), Festiguay and Gamenya (9 each), Olympic (8), Mendos (7), Spica (5), Pinnacle (3), and Stockade, Bordan, and Dural (1 each).

Wheat Experiments

Variety Trials. The 1967–68 randomized and replicated wheat variety trials were arranged with 78 (69 in 1966–67) farmers, working under the supervision of 22 (21) district agronomists and testing a total of 18 (18) varieties. Wheat variety trials were conducted, also, on seven Research Stations, testing and comparing with standard varieties many promising crossbreds and new varieties.

At Glen Innes Research Station trials were recommenced after a lapse of nearly 30 years. This reflects renewed interest in wheatgrowing on the northern tablelands.

In this adverse season a number of trials failed. Even so, 95 were harvested, compared with 94 in 1966–67.

In the north the new varieties under test included Mendos, Gamut, and Timgalen. The dry season demonstrated the good drought resistance and adaptability of Gamenya. The recently named Timgalen (TR135) yielded equal to Mendos but a little inferior to Gamut. Because of its later maturity Festiguay yielded poorly in comparison with the other standard varieties.

In central and southern trials the new varieties tested included N.B. Javelin 115, Timgalen, Robin, AR Falcon 28A, and Summit. Despite the dry season, N.B. Javelin 115 compared more than favourably with Olympic, but its superiority was much less than in the very good season of 1966. In view of its satisfactory performance over recent years, application was made in May, 1968, for naming and registration of this crossbred. Timgalen proved about equal to Gamut, and each was much inferior to Gamenya. Robin was equal in yield to Heron, and AR Falcon 28A (a Falcon backcross line possessing resistance to all prevalent strains of stem rust) equalled Falcon. Summit was inferior to Pinnacle.

Soil Fertility and Rotation Experiment. This project at Condobolin Research Station completed its twelfth year and hence its first cycle.

Rainfall on the fallows was very high, but the first seven months of 1967 except March were very dry. The remaining months were dry, except for timely rain in August and October which prevented complete crop failure.

The wheat plots were sown in late May. They yielded poorly. Once again the yields from the long fallow plots (average of 12.9 bushels/acre) were significantly higher than from the medium and short fallows (average of 9.6 and 9.6 bushels/acre, respectively). The previous cropping and pasture history had little effect on yield.

The oat plots were also sown in late May. The yields were even lower than for wheat (by 4–5 bushels/acre) and this was attributable to second growth after October rains, shattering, and bird damage.

The grazing oat plots were sown in early March, after a good rain. Growth early was slow, but four cuts were made in the winter and early spring.

Grazing from the lucerne and sown pasture and native pasture plots was poor to fair in this dry season. However, satisfactory establishment was obtained from the lucerne and pasture plots sown in the autumn.

Skeleton weed and barley grass are now problems throughout the trial area.

Irrigated Wheat. Irrigation wheat sowings in the southwest totalled about 182,000 acres in 1967, compared with 106,000 in 1960, and 33,000 in 1958.

A research project to investigate the problems of growing wheat under irrigation has been started at Yanco. This includes studies on fertilizer use, times and frequency of watering, seed rates, varieties, etc. From the limited number of trials in the past season the results suggest that times of watering could be the most important factor for maximum yield.

Wheat Fertilizer Trials. In the north most of the wheat fertilizer work in 1967 was concerned with varietal response to various levels of phosphorus and nitrogen. The standard recommended varieties Mendos, Gamut, Festiguay, and Timgalen, a promising crossbred M8127, two high-yielding introductions with low quality (Mexico 120 and Chili 1B), and a promising durum crossbred were included.

Two of these trials were irrigated. Yields from most of the trials were low in this dry season and some failed due to severe drought.

Because of northern wheat area increasing interest in growing barley the responses of two malting barleys (Prior and Research) to various rates of phosphorus and nitrogen fertilizers were studied. In the dry conditions yields were low and some trials had to be abandoned.

In central New South Wales, the wheat plant nutrition programme stemming from Condobolin Research Station completed its fourth year. Sowings commenced in early May, but at most sites seedbed moisture was not satisfactory until early June. Sowing continued until mid-July. Except in August and October rainfall was below average. This and the generally late sowing resulted in low yields and even failure in some trials.

As well as the standard nitrogen x phosphorus trials, other investigations were conducted on variety x fertilizer interactions, potash, forms of nitrogen, cycocel, etc. A large sowing programme was fulfilled at Trangie Research Station, but these trials had to be abandoned in the severe drought.

The fertilizer work stemming from Cowra Research Station was greatly intensified in 1967 and, because of the generally more favourable season than in the western areas, much useful information was obtained.

The fertilizer programme has been further enlarged in 1968 with the appointment of a research agronomist to Trangie Research Station to conduct trials in the northern part of the central west.

Field Wheat Competitions

Six divisional dryland championships were conducted in 1967 by the R.A.S. Most of the local and all of the championship judging was done by officers of this Department. The total of crops judged was 628, entered in 73 local competitions. This contrasted with the 957 crops in 83 local competitions in 1966, and with the 295 crops in 31 local competitions in 1965.

Entries in some local competitions were pre-judged by farmer judges to reduce the local total to the maximum of 10 crops allowed to be judged by Departmental officers.

The following statistics are of interest for the 1967 dryland competitions:

Division	Local Competitions	Local Entries	Championship Crop	
			Variety	Est. Yield Bsh/acre
Northern	11	82	Gamut	44
Northern Slopes	13	108	Gamut	54
Central	12	137	Pinnacle	60
Central Slopes	12	105	Falcon	44
Riverina	14	119	Falcon	43
Southern Slopes	11	77	Bordan	45
Total	73	628		

In addition to the dryland competitions, the R.A.S. in 1967 inaugurated a series of Irrigated Field Wheat Competitions. These were conducted by six societies, in two Divisions of the State. The Department was not involved in the judging but advised the R.A.S. on judging procedures, scale of points, etc.

Gamenya estimated to yield 66 bushels/acre was the winning irrigated entry in the Central Division. Pinnacle estimated to yield 60 bushels/acre won the Southern Division irrigated competitions.

OATS

Production

The total area sown for all purposes in 1967–68 was estimated to be 1,811,200 acres; about average for the preceding decade. About 900,000 acres were sown for straight out grazing.

The grain harvest was estimated to be the lowest since 1959–60. The yield was 8,236,000 bushels, from a harvested area of about 700,000 acres; a yield average of 11.8 bushels per harvested acre. Hay production was estimated at about 98,000 tons from 100,000 acres at an average yield of 1.0 ton per acre.

In the previous season a record 40,904,500 bushels of grain had been produced from a sown area of 1,362,600 acres; a record yield average of 30 bushels per sown acre. Total sowing for all purposes in that year (1966–67) was also a record 2,186,400 acres.

The 1967–68 season was mostly unfavourable for oat crops except on the coast and some northern sections of the tablelands and slopes. Good grazing was had from early sowings in northern and central areas, but recovery was adversely affected by dry conditions. Crops tended to run prematurely to head and were grazed out. In southern areas the very dry season throughout was most unfavourable, thus little grazing was had and grain yields were light.

Oat Variety Popularities

Statistics for the 1966–67 season (latest available) showed only two changes in order of the leading 10 varieties. Belar fell from third to fourth and Algerian rose from fourth to third place.

Cooba, which in 1965–66 became the most popular variety, had increased from 22.6 to 29.4 per cent of the total acreage. There was little change in the percentage area of the other varieties. Greatest changes were Belar, from 13.1 to 11.2 per cent, and Fulghum from 5.6 to 4.7 per cent.

Oat Variety Recommendations

Coolabah, a new variety bred at Temora Research Station, was added to recommendations for most central and southern areas as a replacement for Fulghum. Coolabah's main advantages over Fulghum are relatively strong straw, moderate smut resistance, and higher overall yield.

Sown early (February or March), Coolabah will produce early feed more quickly but overall quantity of forage is inferior to that of Cooba. Sown later (April), Coolabah will produce a moderate quantity of winter feed and recover well for grain. Sown late, Coolabah's green feed production is very slow.

Oat Experiments

Variety Trials.—Randomised and replicated oat variety trials were arranged with 43 farmers (40 farmers in 1966–67) under the supervision of 25 (20) District agronomists and tested 17 (13) varieties. Oat variety trials were conducted also at eight Research Stations. Many promising crossbreds and new varieties were tested in comparisons with standard varieties.

Oat Variety Performances.—The crossbred Avon x Osage M1255 bred at Temora Research Station performed well compared with Avon. It is being seed increased for possible release next season. It exhibits quick early feed and high grain production, usually slightly superior to Avon.

In some areas good falls of rain in early March enabled some grazing trials to be sown, but the dry winter slowed down green feed production. The season favoured early maturing varieties.

Irwin, a newly released variety from Western Australia performed well, but it does not recover well after grazing and is inferior to good grain yielders such as Avon and Bundy in an average season. It is unlikely to be widely grown.

Oat Improvement in the North.—An oat breeder has been appointed to the vacancy at Glen Innes Research Station and will proceed with the breeding programme which had been in abeyance for over three years. Much of the old material has been sown for observation and selection.

Rate of Seed and Fertilizer Experiment on Grazing Oats.—A trial to determine effects of nitrogenous fertilizer on green forage production and grain recovery of oats at two different times of application and two sowing rates was carried out at Glen Innes Research Station. A basal application of 1 cwt superphosphate/acre was applied to the site. Two grazing cuts were made. The highest dry matter yields came from the high seeding rate x high nitrogen treatment. Grain recovery results were rather variable.

BARLEY

Production

Interest in barley for feed grain and for malting continued. Statistics are not as yet available but the acreage sown in 1967–68 is known to have been close to the record 431,700 acres of 1966–67. Grain production in 1967–68 was estimated at 4,800,000 bushels; less than half of the record 1966–67 production.

1966–67, the latest season for which statistics are available, 11,779,000 bushels (7,342,000 of 2-row types and 4,437,000 of 6-row types) were harvested from 385,300 acres sown for grain (245,100 acres of 2-row and 140,200 of 6-row types) for an overall record yield average of 30.5 bushels/acre.

In 1967–68, because of the dry season and light yields the barley grain was relatively high in protein content and in such cases less acceptable to maltsters. In the drier areas most barley produced was retained for seed.

Barley Experiments

Barley Variety Trials.—Randomised and replicated variety trials were arranged with 21 (17 in 1966–67) farmers, supervised by 16 (14) District agronomists, testing 11 (10) varieties. Also, trials were conducted at Wagga Agricultural College and the Trangie and Condobolin Research Stations. Sixteen trials were harvested.

Barley Variety Performances.—In the dry season early maturing varieties were favoured. Noyep, Prior, Maltworthy and Beecher did well under dryland conditions and Dampier, a recent introduction from Western Australia, showed much promise. Abyssinian, which outyields all other varieties in an average to good season, yielded poorly because of its medium to late maturity.

WHEAT, OATS, BARLEY PURE SEED PRODUCTION

Supplies of pure seed of recommended and promising varieties of wheat, oats and barley were maintained at eight Research Stations and distributed through Registered Seed Growers throughout New South Wales. In 1967–68, foundation seed sowings at Research Stations totalled 85 acres of wheat (67 acres in 1966–67), 35 (85) acres of oats and 21 (28) acres of barley. Also, and associated with the above sowings, initial selection and preliminary increase of wheat, oats and barley were done at Temora Research Station.

A total of 298 Registered Seed Growers participated in the Registered Seed Scheme in 1967–68 (267 in 1966–67), and disposed of large quantities of pure seed to other growers.

Registered Seed Wheat Growers totalled 153 (137 in 1966–67), working under the supervision of 24 (22) District agronomists throughout the wheat belt, using foundation seed supplied by this Department. They undertook seed increase of 15 (14) varieties.

Registered Seed Oat Growers totalled 116 (106 in 1966–67) in 25 (23) District agronomist areas and seed increased 14 (12) oat varieties.

Registered Seed Barley growers totalled 29 (24 in 1966–67) and undertook pure seed production of 7 (8) barley varieties in 15 (14) District agronomist areas.

CEREAL RYE

Production

Latest available statistics are for 1966–67, when 21,000 acres of rye were sown for all purposes and 12,729 were utilized for green fodder or hay whilst 155,139 bushels of grain were harvested from 8,586 acres.

The 1967–68 acreage was much less and grain production has been estimated as below the average for the previous decade (55,000 bushels). The reduced sowings were because of grain carryover from 1966 and the dry first half of 1967.

The light production of rye grain in 1967–68 has been a matter of concern to local manufacturers. They had to arrange importation of rye grain from overseas to satisfy their needs.

Basic Seed Stocks

The Department maintained basic seed stocks of Weethalle and Strain 8, and distributed seed of each to co-operating farmers for seed increase and general distribution to other growers.

MAIZE

Production

Bigger Acreage. Area sown to maize increased by about 10 per cent to 67,000 acres. Inland irrigation development and awareness of market outlets were largely responsible. Maize use in hammermilled form for dairy stock and pigs, special purpose starch manufacture, and prospects of overseas trade in grain, increased interest in the crop.

Favourable Yield. Flooding on the north coast early in 1968 jeopardized crops, but recovery was generally good and conditions for ripening were excellent. Dry, hot weather in inland districts was a threat to pollination, and irrigation water shortage prevented many crops from producing to the full.

Production, despite the conditions, has been estimated at 3¼ million bushels, a total unattained since the late 1930's. Increased use of higher plant populations with present-day hybrids and attention to nutrition, especially nitrogen, were major contributors.

Hybrid Capabilities. The genetic capabilities of hybrids were again demonstrated, in yields of from 150 to 200 bushels/acre from particular areas of irrigated inland plots and also from late maturing hybrids on the coast.

Individual inland properties planted up to 1,250 acres of maize. Their harvested area was reduced only by lack of water and immediate stock fodder needs in this abnormally dry season.

Mechanical Harvesting More General. This prerequisite of large area inland farms became more general in coastal areas.

Auxilliary-heated Grain Driers.—Many large-scale inland producers installed these to avoid delays in harvesting and marketing.

Waxy Maize

Contract Acreage. Trade requirements for starch from the waxy maize hybrid N.E.H. 1215wx resulted in about 2,500 acres of this hybrid being grown under contract. Production increased from 1,500 to over 4,000 tons.

Seed Poduction. Area sown for N.E.H. 1215wx seed production increased from 16 to 40 acres.

Seed of a new hybrid with waxy starch characteristics was produced by a private seed firm for the first time.

Nutritional Disorders of Maize

Zinc Deficiency. In new irrigation areas with alkaline soils zinc deficiency had to be combatted. This was by dusting seed with zinc oxide and by spraying the young crop with zinc sulphate. The probability of other minor element deficiencies indicated under stress conditions was investigated.

Molybdenum Deficiency. In north coast areas molybdenum deficiency originating in low molybdenum levels in seed maize was again evident. This necessitated crop spraying with sodium molybdate and use of this compound to raise the molybdenum level of hybrid maize seed.

Hybrid Maize Improvement Programmes

Commercial. Commercial seed producers became interested in hybrid maize seed production using imported parent material, mainly from U.S.A. A large number of inbred lines were grown under quarantine conditions with Departmental co-operation.

Departmental. The programmes to improve early and late maturing hybrids were continued respectively at Glen Innes and Grafton Agricultural Research Stations.

Flooding of the growing areas at Grafton, the fourth year in succession, caused major losses in some plots. Sowings were delayed at Glen Innes by adverse seasonal conditions early, which were fully compensated by irrigation.

Over 300 inbred lines including white and yellow endosperm, waxy starch, and high lysine (opaque-2) types were maintained. Development of modified genotype inbreds to meet specific needs of commercial production, processing, and seed production was continued.

At Glen Innes, introductions from France and Greece were not promising but those from northern U.S.A. showed good combining ability. A new line of inbred B14 proved to be rust resistant. Inbreds VE52 and VA44 from Virginia, SD15 from South Dakota, and B58 from Iowa showed good characteristics. The inbred line HD2271 exhibited the double cobbing character, good stalk strength, but lateness to flower.

Some local derivatives of the inbred line C103 showed stronger growth and better pollen shedding/silking synchronization than any introduced form of C103.

Inbred lines of Wellingrove, Golden Glow, and Golden Superb were advanced a further generation. A Golden Superb line showed promise.

Development of leaf blight resistant parental material for early maturing hybrids, using the Ht (necrotic lesion) source of resistance, is not as advanced as U.S.A. material. The latter now provides an extensive range of inbreds for introduction.

Development of male sterile waxy maize inbreds continued, using the blue aleurone marker to detect the recessive gene. Eight introduced waxy maize inbreds were received and grown for seed increase.

Exchange of inbreds was conducted between Queensland and New South Wales. The Department co-operated with numerous commercial firms in seed production and hybrid testing.

At Grafton. 105 selections were advanced through various inbreeding generations and 10 lines reached combining ability tests. Maintenance work continued with 126 yellow endosperm and 24 white endosperm inbred lines.

Top crosses were synthesized of inbred lines introduced from U.S.A. in 1966 to permit testing of combining ability. Individual crosses were made in nine isolated blocks for inbred evaluation.

Five isogenic fertility restoring and male sterile non-fertility restoring lines—CA, FF4, M3, M42, and NN1—were produced and others continued through development phases. Seed increase areas of converted inbreds 21MS, YIMS, and C121MS were sown and the replacement of male sterile cytoplasm with normal cytoplasm was achieved with inbreds 25R and 23R.

Seed production of G.H.128 hybrid (Y1Ms x M1) (25R x 23R) was investigated in relation to a breakdown in sterility of Y1MS x M1. Work suggested that M1 is a partial fertility restorer although originally classed and observed as a reliable non-restorer. Mutation or unusual seasonal conditions were suspected as causing expression of fertility restoration and this required investigation.

A start was made in conversion of elite inbred lines to the opaque-2 genotype for high lysine hybrids.

Hybrid Maize Trials

Eleven trials each of early maturing hybrids, midseason maturing hybrids, and late maturing hybrids were conducted at research stations or on co-operator farms as an aid to breeding programmes. The several years results of such trials to 1966–67 have been collated for distribution and publication.

Early maturing hybrids N.E.H.7, N.E.H.1151, N.E.H.1215wx, and N.E.S.1002, and also DeKalb Shand hybrids D.S.28, D.S.606A, and D.S.601 performed well. N.E.H.1303, a new hybrid, showed promise.

Late maturing G.H.128 and mid maturing G.M.211 continued to perform satisfactorily. Several new late maturing lines showed promise.

Four very early maturing conventional hybrids were again tested but showed a sacrifice in yield for earliness.

The semi-dwarf hybrid XL45-11 developed by the DeKalb Shand Company showed promise in this initial year of release.

Extension Activities

Plant Populations and Fertilizer. Trials were conducted at the Narrabri and Leeton Research Stations to show optimum plant populations and fertilizer use. Extension in this field was intensified.

Fertilizer/plant population trials were affected by the severe seasonal conditions and soil moisture shortages. Yield reductions were recorded at only moderately high levels of nitrogen because of lack of moisture. These affected overall results.

Coastal growers were encouraged to sow more carefully and to use more fertilizer. These factors and favourable climatic conditions resulted in unusually high yields. One crop produced 150 bushels per acre.

Plant Population and Row Spacing under Irrigation. Departmental and farmer trials indicated that a plant population around 20,000 plants per acre under irrigation was more important than row spacing. Row spacings of more than 36 in to 42 in were not warranted whilst benefits from narrower spacings were dependent on the farmer's ability to conduct normal cultural practices, to irrigate uniformly, and to prevent induced lodging.

High Yield Competition Crops. Competition crops at Mudgee again produced yields over 200 bushels per acre. A demonstration area of the DeKalb Shand hybrid XL45-11 produced 200 bushels per acre and was able to be harvested three weeks before the early maturing hybrid D.S.28.

Weed Control. At 2–3 lb per acre atrazine continued to be the most effective weed control spray in maize crops. It was not used extensively on the coast where rotation with susceptible crops is practised, but its use on inland crops increased.

Hybrid Maize Seed Certification

Hybrid maize seed certification details were as follows:

Hybrid	Growers	Acres	Production		Yield Average	
			50-lb sacks	Bushels	Sacks/ acre	Bushels/ acre
Early	12	61	2,004	1,789	32·8	29·3
Midseason ..	13	72	2,143	1,913	29·7	26·6
Late	37	439	17,789	15,883	40·5	36·2
Totals ..	62	572	21,936	19,585	38·3	34·8

The total area registered was greater by 99 acres than in the previous year, and total production showed an increase of 1,107 x 50 lb sacks. About 6 per cent of seed produced became carryover stocks. The popularity of main lines remained high with New South Wales and Queensland growers.

Seed grading nomenclature was revised following grower representation, to remove from acceptable seed the stigma of second grade. A more suitable letter coding replaced grade description.

SWEET CORN

Acreage and Production

About 3,000 acres of sweet corn was grown. The increase compared with 1966–67 was mainly at Tumut-Gundagai. Other production centres were Forbes, Bathurst, Cowra, and Windsor.

Hot, dry growing conditions, with scarcity of irrigation water, caused below average yields in all areas. The leaf blotch condition peculiar to the main variety Iochief also appeared to affect yields.

New varieties, NK195 and NK199, of American origin and produced by a private seed firm, performed well and showed much promise.

Sweet Corn Improvement Programme

Component inbreds of Iochief were maintained at Glen Innes Agricultural Research Station, with selection for lines free of leaf blotching and with good flowering synchronization—for seed production. Development of eight inbred lines as male sterile and fertility restoring parents continued through a further generation.

Performance studies were made with Iochief, Golden Cross Bantam, Illinchief and Illingold Super Sweet hybrids, Tenngold 5, Tenngold 2 and three other crosses involving Tennessee inbreds. The Tennessee hybrids were all inferior to Iochief in production and quality.

Sweet Corn Seed Certification

Forty-one acres were registered for production of Iochief sweet corn seed. About 800 bushels were certified for use during the season.

POPCORN

Acreage and Production

Commercial popcorn production was confined to contract growing for commercial firms. Requirements were exceeded and some deliveries did not have to be made.

Popcorn Improvement Programme

Seed stocks of inbreds SAA1–6 and SA1490–3, the components of N.E.P.37, were increased at Glen Innes Agricultural Research Station.

Eckhardt isolates of SAA1–6, SA1490–3 and Sg18 were advanced one backcross generation, whilst the fertile isolates of SAA1–6 and SA1490–3 were advanced to the first selfing generation.

GRAIN SORGHUM

Acreage and Production

The estimated yield of 3.25 million bushels from the 133,000 acres sown were records for New South Wales. Grain sorghum interest in new and established irrigation areas resulted in an estimated 70,000 acres being harvested.

This was although, for the fourth consecutive year, dry summer conditions restricted grain sorghum production. The non-irrigated areas in the northwest were not sown until January, 1968, because of dry seedbeds. At least 60,000 acres of the area sown failed to produce grain due to ensuing dry weather and sorghum midge infestation. Early winter rains caused difficulty with harvesting in the south.

Isolated crops yielded 3 to 4 tons of grain/acre. The yield average for irrigated land was estimated at 1.7 tons/acre. The estimated yield average for rain-grown crops was 0.8 tons per acre.

There was increased adoption of higher plant populations and heavy fertilizer use in predominantly furrow irrigated crops. Irrigated crops represented a quarter of the sown area, half of the harvested area and gave two-thirds of the production.

Besides the increasing domestic use of the processed grain in pig and poultry rations. Japanese traders and their agents have stimulated interest in growing the crop.

Japanese traders indicated a need of a million tons of sorghum grain for export. Australian Fertilizers Ltd contracted with growers for production of 30,000 tons, and Wright Stephenson Pty Ltd contracted for 2,000 tons. The total contract target for export was not reached, due to drought.

Local prices for sorghum grain reached $55 per ton compared with the contract price of $41 at the same coastal delivery point.

Hybrid seed comprising that of American companies DeKalb, Northrup King, Pacific, and Pioneer, and that developed by the Queensland Department of Primary Industries from Texas (U.S.A.) material, was readily available to growers. This permitted a selection of maturity ratings.

Waxy sorghum (Combine Kafir Waxy) was sown on about 2,000 acres under contract to Wheat Industries Aust. Ltd for processing.

Grain Sorghum Trials

No sorghum breeding work was conducted by the Department. Emphasis was on evaluation of the wide range of available hybrids available to growers from private sources.

Trials of grain sorghum hybrids were arranged at sixteen growing centres. Twenty-two hybrids developed from U.S.D.A,. Northrup King, Pacific, DeKalb and Pioneer breeding lines were tested. These were: Tx608, Tx610, Tx626, Tx671 and Brolga (U.S.D.A. components); NK200, NK212, NK200Y, NK283, NK310 and NK6318 (Northrup King); C44B, C45A, E56A, E57 and F 64 (DeKalb Shand); Pioneer 846 and PXO (Pioneer); Pacific 007, 222, 361 and 579 (Pacific).

Yield was the main consideration but the important characters maturity, height, head type, grain colour, disease resistance and threshability were also assessed.

In the later maturing group Texas 610 retained its high rating and E57, NK212 and Texas 671 were also impressive.

Earlier maturing hybrids NK200, NK220Y and C44 produced well. The very early hybrid Pacific 007 produced well and showed tolerance of high plant populations in one trial.

The results of grain sorghum variety trials for 1965–66 and 1966–67 have been summarized and tabulated, and distributed to Departmental officers and interested seed firms.

Experiments

Seeding Rates and Plant Populations.—Soil conditions thwarted attempts to evaluate very high population levels, but up to 100,000 plants per acre were achieved. At this level responses per increment were small, indicating little possible advantage in higher populations. Yields of 3 to 3½ tons/acre were obtained in the 100,000 plant level with the midseason to late varieties tested. In variety trials under good irrigation conditions, some varieties showed tolerance of populations up to 150,000, but no benefit in yield.

Fertilizer Trials.—These were influenced by moisture availability. Application levels beyond 60 lb of nitrogen per acre gave yield reductions in some instances.

Grain Sorghum Seed Certification

The Queensland Department of Primary Industries was given full co-operation in its hybrid breeding programmes. No hybrid sorghum breeding or seed certification was undertaken by this Department.

Certified seed produced by the hybrid sorghum seed growers in Queensland was freely available to growers in N.S.W.

De Kalb Shand and Northrup King hybrid seed production activities were confined to N.S.W., and marketing was through normal trade channels.

FORAGE SORGHUMS

Production Trends, and Hybrid Sources

Production Trends.—Hybrid forage sorghums constituted the bulk of summer forage crop sown for grazing purposes. Sweet sorghums and sudan grasses were less popular for this purpose, although for silage making the sweet sorghums were more productive.

Hybrids.—Hybrids available readily from commercial seed firms were Sudax SX-11 and FS22A (DeKalb Shand); Sordan and Trudan II (Northrup King); Zulu (Queensland Department of Primary Industries); Forager, previously Calala (Andersons Seeds); and Suhy 5 (Pacific Seeds). Sudax SX-11 was the most popular, with adaptability to most localities and purposes.

Forage Sorghum Trials

Yield trials conducted by the Department since 1961 have been summarized and the results distributed to Departmental officers and participating seed firms.

Because of the divergent types developed, with either grazing or silage potential the 1967–68 trials were conducted separately for these two purposes; with pre-selection of varieties according to type. Trials were arranged for seven Research Stations and eight District sites.

Investigations on the southern tablelands with merino weaners showed no difference between hybrid forage sorghum, millet and lucerne in effect on body weight increments or wool production.

Nitrogen applications improved quantity and quality of plant growth but because of the increase likely in HCN content with use of this fertilizer only moderate levels of nitrogen were applied in practice.

Forage Sorghum Improvement Work

The Department's work was confined to evaluation of hybrids available. No breeding work was undertaken.

Forage Sorghum Seed Certification

Seed certification was confined to the open-pollinated varieties of sweet sorghum; Saccaline 16 acres and Early Orange 27½ acres.

MILLETS

Broom Millet Acreage and Production

Production of broom millet was estimated at 900 short tons, from about 1,950 acres. Whilst acreage was the same as in 1966–67, the yield estimate was up 90 short tons—largely due to flood-free harvesting conditions in the Lismore area. Prices ranged from $450 to $505 per short ton.

Conditions elsewhere than Lismore were difficult; successive dry weather and flooding at Maitland; dry weather and limited irrigation water at Tumut and Barham.

The White Italian variety was grown widely. There were a few exploratory areas of the variety Dwarf Tan.

Broom Millet Improvement

Fourteen selections from six varieties were grown for observation and pure seed production at Glen Innes Agricultural Research Station. Brush characteristics of the majority of White Italian selections were superior. Apparent red stain resistance was noted in two introductions.

Fodder and Grain Millets Production

The extreme summer drought conditions limited fodder and grain millet production.

Japanese millet remained the most useful for early forage production, whilst Siberian and Pearl millets produced more total forage due to their better production later in the season.

Seed of the early-maturing Pearl Millet cultivar Tamworth was successfully produced under irrigation in inland districts, although persistent autumn-winter rain caused harvesting difficulties in the south.

RICE

Acreage and Production

At the time of this report, rice harvesting had not quite been completed. Production is expected to approximate 217,000 tons of paddy from 76,000 acres, compared with the 1966–67 production of 210,939 tons of paddy from 73,820 acres. Thus the yield average per acre is expected to be about the same as for 1966–67, and might even exceed it.

Seasonal conditions favoured high yield and quality until rain in April induced lodging in heavy crops and the continued bad weather in May delayed and complicated harvesting operations.

Liaison with the Industry

The close contact between rice industry representatives and Departmental officers concerned with research and extension continued to promote acceptance of research results. The industry maintained its financial support of the Department's research based at Yanco Agricultural College and Research Station. Support of research and extension was further demonstrated by the attendance of more than 600 people at the Annual Rice Field Day held at the Station.

Aerial Sowing of Rice

Once again aerial sowing of rice was widely practised in the Murray River Irrigation districts. Almost 70 per cent of the 18,800 acres sown to rice there was sown from the air.

Rice Variety Popularities

Calrose retained its popularity in 1967–68, especially in the Murray River areas. Demand for the long-grained variety Kulu for 1967 planting was such that seed had to be distributed on a restriction basis. It was in demand because growers know its ability to yield comparably to the short-grained Calrose and Caloro whilst being also readily saleable at a higher price. There is a degree of variety production control by the industry to relate, according to consumer demand, supply of shorter-grained varieties to the appropriate export markets.

Rice Breeding and Improvement

The rice breeder is undertaking post-graduate study in U.S.A., so only a restricted rice breeding programme proceeded.

Crossing, in the glasshouse, and multiplication of promising material in the glasshouse and in field plots were done in the 1967 winter. Further crossing was done in the normal growing season, and selections were made from the more advanced generation hybrids.

Two promising, very early maturing, long-grained lines were selected from irradiated material for inclusion in future yield tests. Good selection progress for all grain types was made within the late sown breeding material. All the selections are highly photosensitive.

Breeding for early maturity and long grain, in Murray River conditions, was continued in the Barham and Deniliquin districts. Promising varieties were increased for yield testing. These included Fusisaka 3 and 5, Cody, Somewake, Terukotobuti, Hirai, and Kuro-Mochi.

Rice Pure Seed Production

This programme again included Calrose, Caloro II, and Kulu. Early generation increase of Kulu was done at Yanco Agricultural College and Research Station. Other varieties and other stages of Kulu were increased on farmers' properties.

Seed committees continued to be responsible for the later stages of production. Preparation of the seed for sowing is the responsibility of the Rice Marketing Board.

Rice Establishment Research

Timing and depth of ploughing, in combination with aerial and surface sowing methods were investigated.

Aerial sowing after pasture reduced nitrogen losses. Unfortunately, yields were also reduced by serious lodging due to vigorous plant growth.

Late ploughing gave a differential variety response, through reduced nitrogen losses. There was no advantage from deep ploughing.

Additional sulphate of ammonia reduced yields, largely because of lodging in the aerially sown crops.

Pre-germinated seed gave no advantage over dry seed in sod seeding trials.

Sheep grazing between flushings proved very effective in controlling pasture growth.

Rice Water Control

Further research into water management showed that a weekly watering led to very poor yields. Increasing the water depth from 1 to 9 in increased plant height, but decreased tillering and yield average. Shallow water led to increased competition from certain weeds. Deep water hastened flowering.

Rice Nutrition Research

Nutrition research was continued in relation to a soil testing service, and also by examining times, materials, and rates of fertilizer application.

In the continuing Pilot Soil Testing Scheme, a review identified some difficulties. Testing will continue on a much restricted basis for another year. Then results will again be reviewed.

An examination of interaction of variety and nitrogen revealed distinct differences between varieties in ability to use applied nitrogen. Nitrogen sources and rates also were tested. Slow release forms of nitrogen, and nitrification inhibitors, were tested for the first time. This work will be further developed.

Influence of trace elements on rice production was examined. This will be further investigated.

Topdressing experiments continued. There were responses to application of lower rates of sulphate of ammonia, but the results were inconclusive. Further, at high rates of sulphate of ammonia there were serious lodging and yield decreases.

Forage Legumes

VETCHES

North Coast interest in vetches as a spring fodder crop declined due to incidence of stem and root rots in the wet autumn conditions. Investigations into vetch disease problems continued at the Wollongbar Agricultural Research Station.

The main variety used commercially was Golden Tares, with most seed coming from Tasmania. A new *Vicia sativa* strain selected in Tasmania is now being tested here.

Seed production of *Vicia dasycarpa* CPI 15905, named Namoi, has been started. This species showed its superiority over other lines of *Vicia dasycarpa* in investigations by the Wheat Research Institute at Narrabri.

COWPEAS

Inland sowing for grazing and seed production were limited by drought conditions. Area fell from 10,000 acres in the previous season to less than 5,000 acres, largely sown in the Coonabarabran and Narrabri areas.

Caloona, with some stem rot resistance, replaced Poona as the main grazing variety in North Coast sowings.

Cowpea popularity declined on the North Coast, a result of losses through disease in previous seasons and the competition from the more disease resistant Lablab bean. Caloona cowpeas retained popularity in the Taree area for earlier feed, although areas further north showed the marked trend to lablab bean.

Cotton

PRODUCTION TRENDS

Record Acreage, Record Yield Average and Record Production

The 1967–68 N.S.W. cotton crop produced a record; an estimated 114,000 bales from the estimated 51,200 acres planted. This N.S.W. production virtually equalled the Australian spinners' raw cotton requirements from Australian sources.

This is an outstanding performance, having regard for the fact that as recently as 5 years earlier, in 1962–63, the production was 2,075 bales from 2,360 acres.

The previous record production for N.S.W. was in the 1965–66 season when 33,176 acres produced 71,720 bales.

Besides the record planted acreage and record production total the yield average estimated at 2.23 bales/acre is also a record. The previous record was 2.17 bales/acre from the 1965–66 crop.

The Namoi Valley Area

The Namoi Valley area increased its importance as a cotton producing area. By estimate, it produced from an estimated 44,500 acres 103,000 of the State's 114,000 bales, at a yield average of 2.31 bales/acre.

At the end of the 1966–67 season, Keepit Dam was at only 13 per cent storage level. Even so, growers prepared for a planting larger than the preceding season's 27,500 acres. Useful winter-spring rainfall alleviated the position and in September 8 inches of water per licensed acre were allocated. These water supplies were capable of supplementation by ground water supplies from bores that could in an emergency maintain 18,000 to 20,000 acres of cotton.

Lacking good rains in the latter part of the year, crops became increasingly stressed. By early January growers were planning to plough in some of their acreage because of severe drought stress. From early to mid January, heavy rains retrieved the position and replenished the Keepit Dam storage. Then conditions for cotton were favourable through February-April.

The adequate irrigation water permitted the crop to mature well and produce high yields. Yields would have been even higher but for harvesting conditions during the unusually wet May.

The Macquarie River Valley-Bourke Area

This became the second from most important cotton region in N.S.W. An estimated 5,500 acres of cotton produced about 10,000 bales. Seasonal conditions on the Macquarie were similar to those on the Namoi, but irrigation water was not in short supply.

Establishment of a gin near Warren has improved the prospects for expansion of cotton growing in that area.

The Southern Irrigation Districts

An estimated 1,200 acres were planted. Prior to advent of bad harvesting conditions, a yield of 1,000 bales was anticipated. Shortage of irrigation water in some cases adversely affected crop prospects. Subsequent wet conditions delayed harvesting. The harvest was incomplete at the end of June, 1967.

Commonwealth Cotton Bounty

The cotton industry over the harvest periods from 1964 to 1968 has benefited by a bounty. This applied to raw cotton produced and used within Australia. The Raw Cotton Bounty Act of 1963–65 provides a maximum of $4 million per annum for this.

The "basic" bounty rate of 13.4375 cents/lb of raw cotton for "middling 1 inch white" is varied by a system of discounts and premiums according to grade and staple length. As total production of raw cotton rises above about 60,000 bales per annum the payment average is reduced proportionately.

Spinners' requirements have been assessed at 111,000 bales of Australian grown raw cotton. But Australian production has been estimated at 148,000 bales; with N.S.W. predicted as likely to produce 114,000 of that total. This 1968 harvest is the final one subject to the present Bounty Act, and disposal of 37,000 bales has created a considerable industry problem. If exported, this cotton would not be subject to bounty. The effect of absence of bounty payment, combined with the lower level of bounty applicable to the record amount of Australian consumed cotton, would be for the producer a significant downturn in the price average/lb for raw cotton.

COTTON FIBRE RESEARCH LABORATORY

Construction of the Laboratory, approved as far back as 1963, is still withheld because of delays and changes in the proposed Rydalmere building programme.

The research and testing programmes, and staff strength, are restricted by the limits of the air-conditioned laboratory space kindly made available (for a period now approaching 4 years) by the University of New South Wales and Bradmill Industries Ltd.

Samples from plant breeding and field investigation have accumulated over a period of years. The accumulation may only be overcome as facilities and, subsequently, skilled staff develop. Absence of supply of adequate fibre data to complement field investigations and plant breeding has assumed greater importance.

COTTON BREEDING, IMPROVEMENT AND QUARANTINE

The breeding and improvement programme for 1967–68 was restricted by plan, because the Department's cotton breeder would be undertaking post-graduate study in U.S.A., and of a further appointment projected to occur in 1968.

Progeny testing and *Verticillium* wilt testing continued, also initial pure seed production, and limited crossing in the pure seed production enclosure and glasshouse at Narrabri Agricultural Research Station.

A reduced cotton quarantine introduction programme operated. During the season 24 varieties were quarantined at Glen Innes Agricultural Research Station.

Cotton Varieties

Deltapine Smoothleaf remained the dominant variety in N.S.W. Increased acreage of Stoneville 7–02 was grown in the Namoi area, but in the 1967–68 seasonal conditions this variety was not superior to Deltapine Smoothleaf. As a result, Stoneville 7–02 popularity has waned and reduced acreage of it is planned for 1968–69.

In the Macquarie Region Deltapine Smoothleaf was grown almost exclusively.

The south-western districts varietal problem is receiving attention from the cotton breeder at the CSIRO Irrigation Research Station at Griffith. Meantime the problem is hindering acceptance of cotton as a crop there. Apart from the growing of Deltapine Smoothleaf and Empire 289 in that area, there is interest and promise in early maturing Russian cotton varieties and also in Paymaster and CA varieties from U.S.A.

Advanced variety testing was done at three sites in the Namoi area, including Narrabri Agricultural Research Station. In the south-west, advanced testing was conducted at three sites, including Yanco Agricultural College and Research Station, both as row crop and as "broadcast" (or narrow row) cotton. The variety testing in the south west was done in close co-operation with officers of the CSIRO Division of Irrigation Research, Griffith.

At both Yanco and Narrabri Research Stations the cotton research staff conducted a trial in a National Series of Variety Trials. This Series comprises *specially selected* varieties being grown in the two eastern Australian cotton growing States and in north Western Australia. It is a means of studying any environmentally induced physiological changes.

Cotton Harvester Research

A feature of research in south western districts was the construction of a "broadcast" harvester based on plans obtained through the visit of a Departmental officer to the U.S.A. in 1965–66.

In addition to this harvester, a similar machine was located in Queensland and, following modifications planned by the Department of Agriculture machinery officer at Leeton, this also was used in experimental harvesting of broadcast cotton. This work also was done in close co-operation with the CSIRO and local organizations interested in cotton development.

Cotton Production Research

Nitrogen.—Most of the production research in the Namoi area continued to be aimed at learning more about the role of nitrogen in cotton production there. Seven trials were conducted, using rates of nitrogen up to 250 lb per acre. The trials mostly suffered moisture stress through the seasonal conditions as previously outlined. But, over all, responses to nitrogen were greater than in the preceding season. Little difference was noted between varieties in their response to nitrogen.

Investigations into the form of nitrogen and the time and method of application were commenced. Initial results suggest little difference in response to the various forms of nitrogen, though their values may vary with time and method of application.

Estimation of soil nitrogen and plant nitrogen levels as an indication of crop nitrogen requirements has shown some promise.

Verticillium Wilt.—A further survey of *Verticillium* Wilt levels was made in commercial crops. The results were similar to those of the preceding season, but with a significant change from the preceding year in a few crops.

Zinc.—In the Namoi Valley there were cotton responses to zinc applications in an area where sub-soil had been exposed during irrigation layout and development.

Gypsum.—Trials in southwestern areas involving gypsum, cultivation methods and water cut off again showed some yield advantages from gypsum.

Tobacco

ACREAGE, YIELD, TRENDS, RESEARCH

Apart from 30 acres in the south, the N.S.W. tobacco industry is in the area north of Tamworth, extending to Tenterfield and Texas in the Queensland border country. There 1,789 acres of tobacco were grown, mostly in the Ashford-Bonshaw-Yetman districts. This provided a slight increase over the 1,765 acres grown there in 1966–67.

Further improvement in yield average was apparent, compared with preceding years. The estimate is that the average would exceed 1,200 lb/acre and could reach 1,250 lb.

New South Wales was not thought likely to produce quite the quota of leaf allocated to the State, but there are indications that the overall satisfactory early tobacco sales have encouraged growers to prepare for additional acreage in 1968–69.

The organized tobacco marketing system in the three mainland eastern States is by means of an Australian Tobacco Board and respective State Boards. The system continued to function satisfactorily.

As in the previous year, tobacco research in the Ashford area was primarily aimed at sucker and weed control. The sucker control agent penar again showed its effectiveness, whilst benefin exerted good control of a range of weeds and tillam controlled nut grass.

In variety trials, strains of the Hicks variety and others including NC73 were examined.

This year the tobacco research agronomist at Ashford transferred to another position at Tamworth. A decision to transfer the tobacco research headquarters from Ashford to Glen Innes Agricultural Research Station resulted in two agronomists being employed on tobacco research by the end of the year.

Some Miscellaneous Oil, Fibre and Other Crops

SOYBEANS

Production and Consumption Trends

Though $4,000,000 worth of soybeans and soybean products have been imported into Australia in recent years, the crop has never achieved importance in Australian agriculture. New South Wales has about 600 acres sown to soybeans in 1967–68 and Queensland about 4,600 acres.

The 600 acres was the biggest total area yet sown in New South Wales. They in fact comprised trial commercial crops. The largest area was in the Namoi region; mainly in the Quipolly-Caroona district.

Varieties sown reflected the seed availabilities in 1967. In order of area planted they were Semstar, Hill, Wills and Bethel. Hill has appeared to be the most promising, but the considerable promise of Lee was also apparent in small seed increase areas and trials.

Most of the soybean acreage—virtually all irrigated—had a per acre yield average of more than one long ton (37⅓ bushels). The best yield reported was for a block of the variety Hill. This produced at the rate of 56 bushels per acre.

Yield average was higher from the 1967–68 crop than from any previous crop. The reasons have not been defined but two factors could have contributed substantially, viz., the use of a new rhizobial strain in soybean legume inoculum, and the favourable rainfall pattern of January, 1968.

Soybean Research

Breeding.—Importance now attached to soybean research may be gauged from the appointment of a research agronomist (soybean breeding) to Narrabri Agricultural Research Station. This officer received training from the only other soybean breeder in Australia, Dr D. E. Byth, of Queensland University.

The Departmental breeder's objectives are to produce soybean varieties adapted to the various New South Wales localities where this crop is expected to develop. The photo-period behaviour of a soybean variety normally prevents it from being widely adapted.

The breeder has already accumulated some 250 varieties and types in a collection, and has 30 more lines awaiting quarantine testing. He made a number of crosses during the past summer.

Introductions, Seed Increase and Testing.—The programme initiated some years ago was continued.

Detailed trials were sown to reveal relationships between localities and soybean photo-periodic groups, and their component varieties.

Experiments involving interaction of time of sowing and groups of selected varieties, have indicated the more promising varieties for interim commercial production pending development of locally-bred varieties. This work has been at Narrabri, Glen Innes, and Leeton Agricultural Research Stations, supported by trials on northwestern and southwestern farmers' properties.

Nutrition.—Investigations have shown that there will be nutritional problems in the attempts to produce soybeans in certain areas. In heavy black alkaline soils of the Breeza area serious problems have been shown, whilst at Leeton Agricultural Research Station an unexplained condition has prevented crops yielding grain.

Record Yields on Trials.—Soybean yields in trials, as in commercial crops, attained record levels. Each variety in "grouping" trials, from at least one sowing, exceeded 39 bushels/acre, i.e., more than one ton/acre. Lee confirmed its past performances by producing over 55 bushels/acre. Wayne also exceeded 50 bushels/acre. These were the highest ever mean yields from soybean trials in N.S.W.

Soybean Seed Production

All available soybean varieties were seed increased during 1967–68; the most promising on a larger scale, to permit expansion of the trials programme in 1968–69. However, in two ways the seed increase results were disappointing: an unexplained condition mentioned in an earlier paragraph prevented any seed production at Leeton; lack of suitable threshing equipment for this crop, and consequent makeshift methods, lowered the quality of seed harvested elsewhere.

LINSEED

Acreage and Production

Limited market for linseed in Australia continued. Processors undertook to receive agreed quantities from co-operating growers.

The estimated 1967–68 area was 9,500 acres, almost the same as recorded for the preceding season. However, the yield average of less than 8 bushels/acre was not much above half that of 1966–67, because of drought in southern N.S.W. and a severe dry period in spring in the northwest.

Of the 9,500 acres sown, some 8,000 acres were in the northwest and the rest in central and southern districts. Yield average from these latter areas was very low indeed.

Linseed Research

Variety Tests.—Limited variety testing was again carried on; 25 varieties from the world collection were examined for yield and disease performance, whilst 12 introduced from U.S.A. and the Argentine were sown for further testing and seed increase. Because of the drought and mite damage, no results were obtained.

Twelve varieties were sown for advanced testing. These included the most promising types derived from the previous breeding and selection programme.

Three new varieties, Dunes, New River and Imperial, from U.S.A. were passed through quarantine. These were developed for irrigation farming.

SAFFLOWER

Acreage and Production

Acreage climbed steeply to an estimated 13,000 acres in 1967–68. The recorded 1966–67 total was only 5,100 acres. However, yield average was only estimated 5½ bushels/acre as against the 14.1 bushels/acre recorded in 1966–67.

Low yields were the result of inadequate soil moisture satisfactory to mature the crop in late spring-early summer and, in some instances, germination of grain in the head because of summer rain.

Safflower Research

Trials were continued mainly under irrigation, to examine time of sowing, method of irrigation, time of final irrigation, variety performance and seeding rate.

In the northwest, irrigated trials were abandoned because of germination of seed in the head following summer rain.

In southern areas, seed increase was carried out to provide pure seed for further research. The yields were good but for unknown reasons the seed did not attain the required germination standard.

Seventy new safflower lines from U.S.A. for seed increase were received in quarantine.

SUNFLOWER

Acreage and Production

Sunflower acreage fell considerably, reflecting the unsatisfactory previous season, whilst the demand for it for birdseed caused a steep increase in price. The high price commanded by seed from the few hundred acres grown has stimulated interest in the crop for 1968–69.

The higher oil-content varieties were grown in limited quantity in 1967–68; mainly as pure seed areas to provide more seed for 1968–69 sowings.

Departmental Seed Production

As is so with safflower, sunflower cross pollinates. In pure seed production this means adequate isolation of a variety at flowering. Seed increase was conducted at seven Research Stations and on selected private properties, in preparing for further investigations and trial commercial plantings.

Sunflower Research

Variety Testing.—Including the newer higher oil content varieties, in combination with differing fertilizer levels and planting rates, tests were conducted at three centres under irrigation. No consistent result pattern was evident.

In the major variety test at Narrabri Agricultural Research Station the top yield of 2,317 lb/acre was attained by Peredovik P.6296. Six other varieties or lines exceeded 2,000 lb/acre. Polestar, the standard check variety, produced 1,610 lb/acre.

RAPESEED

Import quantities of this oilseed continue to increase.

The programme of irrigated variety testing and seed production initiated in 1966–67 is proceeding. Yields approaching 2,000 lb/acre were produced by the best varieties under test. The highest yield from a seed production plot was at the rate of almost 3,000 lb/acre.

CASTOR BEAN

Seed increase and variety testing continued. The seed increase programme, at seven Research Stations, had variable success.

Sixteen varieties were twice sown for variety testing at Leeton Agricultural Research Station. Each sowing germinated but subsequently died.

SESAME

Seed increase of introduced varieties proceeded at seven Research Stations, in preparation for variety testing.

PEANUTS

Acreage and production in N.S.W. were estimated to be the same as the previous two seasons; about 450 acres, and 225 tons. This level of production is less than 1 per cent of the Australian total.

BLUE MALLEE FOR OIL DISTILLATION

Experiments in co-operation with the Museum of Applied Arts and Sciences were started in 1967 to investigate Blue Mallee production possibilities—for oil distillation.

The work, directed by Museum staff, is under way at Yanco Agricultural College and Research Station. Despite the 1967 drought some establishment was achieved in a one acre block.

In February, 1968, production of seedlings was started for a four acre block designed for machine harvesting of the foliage. Their planting out is scheduled for the 1968 winter.

Vegetables

A GENERAL NOTE

Nomination of the Principal Agronomist (Vegetables) as Chairman of the Organising Committee for the Australian Vegetable Research Conference, and nomination of the Assistant Principal Agronomist (Vegetables) for an overseas investigational tour sponsored by the Australian Potato Industry and Australian Agricultural Council can be recorded as pleasing compliments to the Department.

PRODUCTION TRENDS

The drought conditions of most of the year did not have a serious impact on the supply position. Some vegetables, notably onions, were in short supply but generally the seasonal vegetables were adequately supplied throughout the year.

Growers in the Murrumbidgee Irrigation Area were allowed priority and did not suffer severely from water usage restrictions. Restrictions were imposed when production from summer crops had virtually ceased.

Trend to Large Scale Production

The trend continued to larger scale production and more mechanized methods. This has been most marked for onion growing, and tomatoes for processing. Availability of suitable chemicals for weed control and of machines for precision sowing have been important in the trend.

Lifting of the Road Transport (Co-ordination) Tax within 150 miles of Sydney and Newcastle has given a fillip to more extensive potato production under irrigation. Potato crisp manufacturers do not now achieve a freight advantage by acquiring their raw material interstate.

POTATOES

Breeding

The breeding programme continued at the Agricultural Research Station, Glen Innes. Late rains were still delaying the harvesting at the end of June, 1968.

Parental Material.—In an extensive crossing programme, 999 separate crosses were made and gave 786 berries. The same wide range of parents as used in 1966–67 were included in the crossings. Emphasis was on locally bred material as male parents.

New parental stock included Virus X resistant lines developed in New Zealand, and Bintje, a high quality yellow fleshed Dutch variety.

In all, 47 female and 49 male parents were used in various combinations.

First Year Seedlings.—Some 27,000 first year seedlings were transplanted, between September and May, and grown in pots embedded in soil. This system was first used last year. It has again given highly satisfactory results.

Second Generation.—Following the increased production of true seed, the total of plants grown in the second generation was increased from 4,000 seedlings representing 340 progenies, to 11,300 seedlings representing 600 lines. 560 single plant selections were made for advance to third year trials. The most promising selections came from the breeding line Navajo x (1563 (c) 14 x (Monak x 11–79)).

Third Year Seedlings.—484 third year seedling lines were planted. Of these, 101 were selected for advance to fourth year testing. The most outstanding selections were from the crosses S2897 x (Kurrel x S2865) (2), and Fundy x S2882. Others showing promise were Pungo x S2855, B595–76 x (1928 (e) x Menominee) x S2901, and Fundy (natural pollination).

Fourth Year Seedlings.—Fourth year seedlings totalled 154, but because rain has delayed the harvesting, selections have not yet been made.

Preliminary Yield Trial.—In the preliminary yield trial at Red Range there are 50 lines. Final selections have yet to be made but among the promising selections would be Walanga x (Sebago x 11–79), Saco x (Saco x Cherokee), (914 (a) 91 x Adina) x (Saco x S2782). S2821 x (B595–76 x Adina), and Navajo x (Saco x Cherokee).

Advanced Yield Trials.—On the northern tablelands at Guyra, and on the central tablelands at Orange Agricultural Research Station, advanced seedlings were tested in replicated trials.

At Guyra rain delayed digging but in the early section of the trial, where 12 varieties were under test, S2929 a selection from B595–76 x Adina and S2946 (Onaway x Adina) again appeared promising. In the late trial, of 10 varieties, S2920 Pungo x (1928 (e) 2 x Cherokee) looked outstanding.

At Orange, Shoshoni from U.S.A., S2894 (S2821 x Merrimack), S2897 (Redskin Selfed) and S2890 (Sequoia x Cortland) performed best in the early maturing trial. S2882 (Monak v 11–79), S2901 (S2864 x Merrimack) and S2883 (Monak x 11–79) all outyielded Kurrel, the check variety, in the late maturing section.

Potato Introductions

Of the introduced varieties, Shoshoni gave a good performance in the advanced yield trial. Penobscot from U.S.A. also appeared promising for local conditions. Bintje, a yellow fleshed Dutch variety was of outstanding quality for crisping but its yield, shape and flesh colour make it unsuitable for other purposes.

Potato Work at Orange Agricultural Research Station

Filling of the vacancy for a research agronomist at Orange Research Station has permitted a start in several additional fields of cultural research.

New Projects.—Among the trials established were:

- A replicated trial to compare the Department's strains of Sebago, Katahdin and Kennebec with recently introduced American strains. Though Katahdin and Sebago were introduced more than 25 years ago, no divergence in type was apparent.
- An irrigated variety trial on a grower's property. Observations on time of tuber set, tuber behaviour, specific gravity and crisping quality were recorded besides yields.
- A time of planting and time of harvesting trial with Kennebec, the preferred variety for crisping. The trial was designed to obtain data to guide growers on the time limits during which Kennebec can be supplied with unimpaired crisping quality.
- A trial with selective pre-emergence herbicides.

Elite Seed Production.—Activities at this Station include production of elite seed. Thirteen varieties are involved. By arrangement with Certified Seed Potatoes N.S.W. Co-operative Ltd it is intended that elite seed of Sebago, the leading variety, will be supplied through the Co-operative to selected growers for further increase.

The first release of elite seed will be made in the coming season but the intention is that eventually all certified seed produced in the State will not be more than four generations removed from elite seed produced at Orange. Here it will have been selected for trueness to type and freedom from virus disease.

Tuber Indexing.—In association with the scheme for production of elite seed, 2,500 potatoes from the varieties Kurrel, Sebago, Exton, Sequoia, Bungama and Kennebec were tuber indexed last season. Desirable tubers from the indexing were planted in the field and the produce from these will form the nucleus of next season's elite seed.

Tuber indexing comprises the growing of a single eye from each tuber, in the glasshouse, and examining the resultant plant for symptoms of virus disease. Laboratory tests are undertaken when necessary to determine whether virus infection is present.

Seed Increase.—A potato seedling increase area was established. Thirty-five individual lines, including introduced varieties, were grown for increase. Observations on the botanical details, yields, specific gravity and crisping quality were recorded.

District Potato Yield Trials

District yield trials were resumed for the first time in several years, on a limited scale.

S2897, derived from a natural pollination of Redskin, performed well at Bathurst, Dorrigo, Kempsey and Robertson. Jala, formerly S2881, gave good results at Kempsey and Robertson where S2902 (Delus x Redskin) also yielded well. Of the named varieties, Sebago, Kurrel and Bungama performed well in most districts.

Production of Certified Potato Seed

In the Potato Seed Certification Scheme 1,090 acres, submitted by 101 growers, were passed for certification. The rate of rejection was only 1 per cent. Last season 917 acres were certified.

Following discussions with the Directors of the Certificated Seed Potatoes N.S.W. Co-operative Ltd, agreement has been reached whereby the elite seed produced at Orange Agricultural Research Station will be introduced into the seed certification scheme.

Seed from Orange will be provided to selected growers who will grow the more popular commercial varieties, the produce to be sold as foundation seed. Foundation seed of the less popular varieties will be obtainable direct from Orange.

Foundation seed will be used to produce mother seed. When the scheme is fully operative only those crops grown from mother seed will be eligible for certification.

Having reached agreement on the conditions to govern the production of certified seed this information had to be conveyed to the growers. This was done at a series of meetings where representatives of the Co-operative and the Department explained the new requirements.

Sebago elite seed produced in 1967–68 will be released to growers for planting next season, to inaugurate the new scheme.

Production of Approved Potato Seed

In its third year of operation, the Approved Seed Scheme attracted applications from 36 growers. They submitted 522 acres for inspection and 451 acres were approved, as against 362 acres in 1966–67.

TOMATOES

Breeding and Improvement

Retirement of the vegetable research officer stationed at Hawkesbury Agricultural College, and temporary difficulties in recruitment, caused suspension of the improvement programme at that College. But breeding was continued at Yanco Agricultural College and Research Station.

Breeding at Yanco.—The breeding has been aimed at development of disease resistant dwarf varieties of good processing quality, suited to hand and machine harvesting. Three lines, two derived from the cross Roma 884 x 255 and one from Long John introduced from U.S.A., have shown promise and were grown for seed increase. This will permit large scale commercial trials, for manual and mechanical harvesting. Six other selections of various parentage and all in advanced generations have shown excellent potential.

In the glasshouse 23 new crosses were made during winter and the F1 generation were grown in the field.

A new method first tested in 1966–67 was used extensively on advanced breeding lines to determine crack resistance.

Tomato Variety Trials at Yanco.—Fifteen varieties were in a replicated trial, using four different harvesting systems. This was to determine varietal suitability for hand and mechanical harvesting and the most suitable stage to harvest each variety where machine harvesting is practised.

In several instances, varieties developed for "once-over" harvesting gave far greater yields from a single harvest at the appropriate stage than from four harvests at weekly intervals.

The most promising for a single harvest were VF13L from the University of California, KC109 from the Heinz Company, and Chico and Chico Grande, the seed of which was obtained by Mr D. Wallin (then Griffith District agronomist) during a visit to the U.S.A.

A Yanco selection of Roma, Campbell No. 17 from the Campbell Soup Company, and Yanco Premium gave the highest yields in the system of four harvests at weekly intervals.

Eight varieties were field tested in trials at three sites in the Murrumbidgee Irrigation Area. The varieties VFN48A, Chico, Chico Grande, and 200–3F4 from the U.S., and Campbell No. 17, were outstanding.

Tomato Introductions.—Ten new varieties were grown for the first time. The most suitable were Harbon, Coldset, and Keeskenoti, all from Canada.

Miscellaneous Work with Tomatoes

Tomato Spotted Wilt Control.—A systemic insecticide, temic 10G, applied with the fertilizer to transplanted tomatoes gave pleasing results. Though response was in proportion to the rate of application, spotted wilt infection had not shown in any treated plot before the start of flowering.

Seedbed Bituminous Mulch.—Observational trials were undertaken at Yanco Agricultural College and Research Station and at three district sites. Bituminous mulch was sprayed on the surface soil after direct seeding of tomatoes. In the mulched treatments germination and early yield were markedly superior.

BEANS

Breeding and Improvement

As with tomatoes, the bean improvement programme at Hawkesbury Agricultural College was temporarily suspended following retirement of the vegetable research officer there.

At Yanco Agricultural College and Research Station the "Summer Death" resistant varieties, Turon, Bland, Yanco, and Leeton, were crossed with varieties of high processing quality. This was to produce a resistant variety with acceptable processing attributes.

Bean Introductions.—Three introduced varieties proved unsuitable to the local environment.

Bean Seed Certification

The area submitted for certification fell from 62 acres in 1966–67 to 37 in 1967–68 and production declined from 440 to 350 bushels. There is an economic reason. N.S.W. growers can choose more profitable crops than beans for seed.

Miscellaneous Work on Beans

The "Summer Death" Problem.—Formerly known as the "Root Rot Complex", this continues to be the greatest problem facing N.S.W. growers of beans for processing.

In conjunction with Division of Science Services, insect traps were used to ascertain whether the trouble if transmissible is insect transmitted. Prevalence of a species of leaf-hopper has been noted.

A range of varieties was grown to determine variety reaction to the disease and whether there is any correlation between reactions to summer death and to curly top, a U.S.A. virus disease similar to but distinct from Summer Death. The correlations obtained favour the possibility of virus.

Manganese Toxicity in Beans.—Research into manganese toxicity and related problems was done at the Tropical Fruit Research Station, Alstonville, co-operative with Division of Science Services.

Positive control by applications of lime was confirmed. A soil testing service was introduced in March, 1968. Growers submit samples to the Chief Chemist to determine the rate of lime needed to counteract manganese toxicity. The service proved popular. Forty growers submitted soil for examination.

ROCKMELONS

Breeding and Improvement

Seven breeding lines, and also recently introduced varieties, were glasshouse tested for reaction to powdery mildew and *Fusarium* wilt. The survivors of this screening were transplanted to the field. Further selections were made in the breeding lines, prior to self pollination for seed production.

Two selections from the cross (36739 x PMR No. 45) x PMR No. 45 and one from the cross (Hales Best x Spartan Rock) x 36379 were grown in isolation blocks for seed increase. Two of them were subsequently named "Yanco Treat" and "Yanco Delight".

The two new varieties are resistant to two virulent diseases widespread in the Murrumbidgee Irrigation Area and are expected to fulfil a most useful role. Seed has been released to the trade for bulk increase.

The breeding work is continuing to improve fruit type while retaining the necessary disease resistance.

Bituminous Mulched Seedbed

Promising results were obtained with bituminous mulch to aid early establishment of rockmelons. At Yanco Agricultural College and Research Station and on two farms, germination percentage was doubled where the mulch was used.

ASPARAGUS

Research at Gundagai continued to be directed by a planning committee comprising representatives of the Department, the Rural Bank of N.S.W. and the Mountain Maid Food Cooperative.

Mechanical Harvesting.—Two asparagus harvesters were extensively tested. One is non-selective. The other cuts only spears of a predetermined length. The trials were most promising.

Further trials have been designed to determine establishment techniques most suited to mechanical harvesting.

Herbicide Trials.—A standard has been adopted for chemical weed control in asparagus as a result of the herbicide comparisons.

LETTUCE

Export Seed Trade.—Export trade in lettuce seed has been developed in recent years by a seed firm. Formerly production of the seed was centred in Victoria, but this season some crops were grown in the Hay district of N.S.W. Unusual weather reduced yields this season but the industry could extend because the climate is excellent for the production of disease free seed.

The Department co-operated in drawing advance samples of seed for preliminary testing overseas, before despatch of the bulk consignments.

Large Scale Growing of Lettuce.—This has been adopted by growers at Hay and in other western districts for capital city markets. Traditionally in N.S.W., lettuce has been grown in market gardens close to Sydney and Newcastle. Demand fluctuates with the weather. There has been no prolonged city shortage under market garden production. Success of large scale growing of this perishable crop in districts far removed from the markets is by no means assured.

Pastures Section

FOURTH AUSTRALIAN GRASSLANDS CONFERENCE

The Fourth Australian Grasslands Conference was held in May, 1968, at Perth. Twelve officers of the N.S.W. Department of Agriculture were in the attendance.

NATURAL PASTURES

Natural pastures cover more than 90 per cent of this State's acreage. Because of their special adaptation to the local extremes of climate, natural pastures made important contributions to the available grazing in the recent dry seasons. Increased research attention has been given to their improvement and utilization.

PASTURE RESEARCH

Staff Resources

Pasture research was continued at 20 centres in N.S.W. by 40 research agronomists. One officer was seconded to the University of New England, eight were located with the CSIRO on research training projects, two were based at Agricultural Research Institutes, four were in Districts undertaking "adaptive" pasture research, and the remaining 25 were at Agricultural Research Stations.

Each of the nine Agricultural Extension Regions was served by at least two Departmental research centres concerned with pasture. Even the North Western Region which has only the Research Station at Narrabri within its borders is also served, in its southern section, by research from the Tamworth Research Station sited within the Northern Region.

A second research agronomist to study pasture improvement at and from Berry on the south coast has been appointed. Funds for employment of a field assistant and for equipment and materials were provided by the locally created organization, the South Coast Agricultural Research and Extension Council.

Two new in-training positions were filled this year by research agronomists. These officers are on secondment for two years in-service training in forage ecology at the CSIRO, Canberra.

Pastures Species and Cultivars: Temperate Species

Phalaris tuberosa.—Effects of the drought were apparent in a stronger interest in phalaris. Persistence of phalaris was outstanding in many areas.

On the southern tablelands, it outyielded cocksfoot and ryegrass on skeletal and porphyry-derived soils. On better quality soils spring sown it died out during the dry summer, but established phalaris survived satisfactorily.

The introduction C.P.I. 19331—now named Sirocco—was superior to Australian Commercial phalaris under the conditions referred to in the preceding paragraph. It also showed promise at Cowra. At Tamworth, it and the new experimental "hybrid" were the most persistent.

Ryegrasses.—The Kangaroo Valley cultivar of perennial ryegrass further demonstrated its adaptability and value on the south coast. The annual and biennial ryegrasses gave more growth than in early spring. But Victorian, Grasslands, Ariki, and Medea were all surpassed by Kangaroo Valley cultivar in dryland trials.

In Kangaroo Valley the best results in seed production were by closing Kangaroo Valley perennial ryegrass paddocks for seed in early August, compared with earlier or later dates of closing.

At Cowra the new Medea cultivar showed better persistence and winter production than other ryegrasses.

The summer drought killed all perennial ryegrasses in trials at Temora. Merredin (an annual) was the outstanding ryegrass.

Cocksfoot.—In trials on the southern tablelands survival of Brignoles and Currie cocksfoots was poor, due to the very dry summer. Under irrigation on the nearby coast, however, cocksfoot yielded outstandingly until the end of summer.

At Temora, Berber cocksfoot and Sirocco and C.P.I. 19305 phalaris proved the most persistent varieties of these perennial species.

Demeter Fescue.—On granitic soil near Glen Innes, Demeter fescue has shown good promise under grazing. It also persisted well during the dry spring and summer at Tamworth, where phalaris was the only other temperate perennial grass to survive.

Other Grasses.—Buffel grass varieties—Biloela, Gayndah and American—and Bambatsi Panic—showed good recovery from the dry weather in the northwest. *Digitaria smutsii* also showed promise for that area. So too did the more edible varieties of *Eragrostis curvula*.

The latter were particularly impressive in western fringe areas of the wheat belt. *Eragrostis* species are being assessed carefully for weed potential due to low palatability, high seed production and ready seedling regeneration.

Grasses for Salty Areas.—Salt tolerance of *Agropyron elongatum* and *Puccinellia capillaris* was confirmed on the southern tablelands. *Agropyron* provided green forage during the dry summer, and utilized moisture from the high water table despite the high concentration of salt. *Puccinellia* provided useful winter grazing.

Lucerne.—Lucerne was outstanding as a pasture and forage species in most districts on the tablelands, slopes and wheat belt plains, especially during the drought months.

Examples of increased acreage include 30,000 acres sown in Condobolin district last year, and in Tamworth district an increase of 60,000 acres in the past 10 years.

Seed production of lucerne increased greatly in the Coonabarabran district. It returned over $400,000 as a cash crop to growers there.

Lucerne meal processing and pelleting have developed as a cash crop industry in a number of areas, including Maitland and Parkes.

At Taree and in other coastal river districts lucerne has not persisted well, especially on poorly drained and heavy structured soils. Potassium deficiency and white-fringed weevil attack were major causes of decline.

At Tamworth in a "rates of stocking" experiment six dry ewes per acre were carried successfully by lucerne in a rotational grazing system over the past two years. Higher rates of stocking have needed hand feeding and have severely damaged the stand.

The Cancreep variety of lucerne was tested at Tamworth under continuous grazing at four sheep per acre. At Narrabri it yielded almost as well as the Hunter River variety over five years of testing; but at that centre no variety has outyielded or out-persisted Hunter River lucerne under irrigated or dryland conditions.

At Narrabri further selections within the Cancreep breeding material has revealed more than 20 lines with good yield and expression of creeping ability.

Barrel Medic.—Jemalong variety of Barrel medic performed well in grazing experiments at Condobolin in the central west, the burr carrying 1.25 dry sheep equivalents per acre through the very dry summer. This compares with 0.56 dry sheep equivalents per acre carried by natural pasture.

Jemalong and Cyprus varieties of Barrel Medic were sown extensively on the central and northwestern plains. Harbinger strand medic was also promising and received some acceptance in the central west.

Subterranean Clover.—Woogenellup (Marrar) subterranean clover replaced other varieties to become the most popular subterranean clover throughout the slopes and tablelands. A big increase in use of Woogenellup was accompanied in the Inverell district by increases in the use of Mt Barker, Geraldton, and Howard varieties. Dwalganup was still the most popular variety in the lower rainfall areas.

White Clover.—This continued to be a basic species in pastures on the coast and tablelands. Ladino was the most favoured commercial cultivar on the coast but was found to be highly susceptible to disease and insect attack. It was widely used under irrigation in the dairy areas of the central coast as a legume companion for Kangaroo Valley ryegrass.

A white clover variety introduced from Israel has shown excellent seedling vigour persistence, yield and seed set in trials at Grafton on a variety of soils. It gave superior forage yield to a naturalized local variety which is also persistent and useful in the area.

Red Clover.—Good results were obtained with red clover in trials on the southern tablelands and on the south coast.

Rose Clover and Cupped Clover.—Rose clover performed well on light soils in the northern and central slopes, whilst cupped clover also showed promise.

"Kenya White" Clover.—"Kenya White" clover (*Trifolium semipilosum*) showed good promise for productivity, persistence and regeneration at Grafton. It was relatively free from disease whilst Ladino white clover and Woogenellup (Marrar) subterranean clovers were suffering severe mildew and rust under the same conditions.

Pasture Species and Cultivars: Subtropical Species

Pasture Legumes.—On the poorer soils *Lotononis bainesii* and siratro gave good growth. Greenleaf desmodium outyielded silverleaf desmodium in most comparisons on the north coast. Establishment problems with lotononis, siratro, and glycine retarded their acceptance by farmers.

Near Taree *Lotononis bainesii* was outstanding for spring growth while siratro gave excellent spring results on ridge country near Grafton.

Introductions that performed well in tests at Grafton and nearby included: *Aeschynomene falcata* P.23, promising in sward and grazing trials; *Cassia rotundifolia* C.P.I. 16358; and *Phaseolus radiatus* P. 6710, a pulse crop which yielded over 1,000 lb seed/acre 14 weeks after a November sowing. Also promising were *Stylosanthes guyanensis* cv. Oxley and *Stylosanthes subsericea*.

Several native glycine species continued to show promise. These included *Glycine tomentella* P. 8175. It gave worthwhile response to superphosphate, and useful seasonal production in comparative trials with siratro.

Pasture Grasses.—Kazungula cultivar of *Setaria spacelata* performed well on the north coast. *Paspalum wettsteinii*, Broadleaf paspalum, also showed promise.

Kikuyu proved excellent both under irrigation and in dryland coastal dairying areas. It was an effective medium for application of nitrogen fertilizers, to grow "carry-over" feed for use in winter and to produce high carrying pastures for spring, summer, and autumn.

Pasture Nutrition and Fertilizer Research

Soil Acidity and Lime.—Soil acidity and the effects of lime have received special emphasis at Canberra.

On the southern tablelands poor pasture results on acid soils of sedimentary origin were improved by additions of phosphorus, nitrogen and lime. The growth of ryegrass on an acid soil was less retarded, compared with its growth on a range of less acid granitic and basaltic soils, than was the growth of lucerne or phalaris.

Main feature studies on acid marshland near Nowra was an outstanding response to lime in the growth of *Lotus* sp. Other responses to lime were associated with poor nodulation or minor element disorders.

Pot trials in the glasshouse confirmed an above-normal requirement of lime by some district soils.

On various soils from the Yass Valley apparently conflicting results indicated need for further research on lime and its effects. Lime use has increased on the southern tablelands and on the temperate coast.

Lime pelleting of legume seeds was recommended throughout the State to improve the effectiveness of legume inoculation. An example of effect is that over 90 per cent of legume seed sold in the Inverell district this year was inoculated and lime pelleted.

Phosphorus.—Identified additional areas of phosphorus deficiency confirmed the widespread need of this element.

On the south coast acute fixation of phosphate was detected in some soils. On the nearby tablelands, the declining effect of light rates (1 and 2 cwt superphosphate/acre), applied 2 years previously, contrasted with the continued good response to higher rates (4 and more cwt/acre).

At Leeton, after 12 years of topdressing during an irrigated pasture phase, it was shown that the total accumulation of superphosphate per acre was the main criterion determining wheat response.

On the coast, higher rates of superphosphate for pasture topdressings have been more widely accepted by landholders, especially where influenced by the Feed Year Assistance Plan.

As an overall note on farm and pastoral acceptance of phosphorus: high analysis phosphate fertilizers were accepted more readily than in the previous year, due to advantages of lower freight and spreading costs. There was a marked trend to greater use of N, P, K mixtures in fertilizers for use on crops, but N, P mixtures gained in popularity for topdressing grasslands in the better rainfall zones.

Sulphur.—In the Murrumbidgee Irrigation Area changes in soil permeability were considered to be related to lucerne responses to a ton of gypsum per acre but a nutritional response to sulphur was also suspected.

On two chocolate soils in the Richmond River area of the north coast, and on "Coal Measure" and granitic soils of the Clarence River area, direct responses to sulphur were measured in clover/paspalum growth. A Kangaroo Creek (Clarence River area) sandstone soil tested in a glasshouse pot trial was shown to be deficient in sulphur, as well as phosphorus and potassium. Investigations were conducted to check other north coast soils for sulphur fertilizer requirements.

The black soils of the northern tablelands and slopes, the Warrumbungle foothills and some other smaller basalt-derived areas, responded to topdressings with gypsum or high sulphur analysis superphosphates.

Gypsum was also used at higher rates on irrigated summer pastures in the far southwest to improve the penetration of water and the consequent production of the pastures.

Potassium.—Deficiencies of potassium for pasture growth have been detected in hitherto unsuspected areas.

Granitic soils as well as some basaltic soils of the northern tablelands have now been shown to need potassium.

South Coast and nearby tablelands soils were surveyed this year. Widespread potassium deficiency was identified in sandstone and shale-derived soils and on some red volcanic soils. Potassium deficiency was found on old cropping land and on some long-term pasture improved lands.

Nitrogen.—The value of fertilizer nitrogen in stimulating growth of grass and grazing cereals was demonstrated in many different environments.

It was widely utilized in coastal dairy production "feed year" practice. Excellent results were achieved by topdressing kikuyu grass with nitrogen for increased length of growing season and greater total forage production. Kikuyu x nitrogen has made a major "feed year" contribution where nitrogen is applied in autumn to produce winter feed, and when applied in late winter to "start the spring earlier".

Increase in the use of nitrogen on pastures and grazing oats was general. Some failures resulted where moisture was inadequate for plant growth.

Minor Elements.—Pot trials in the plant nutrition glasshouse detected a number of minor element disorders. They confirmed field trials at Temora which showed responses to addition of copper to "sedimentary ironbark" soils and of zinc to "mallee" soils.

Zinc deficiencies were also detected by glasshouse tests of soils from Dareton and Barham.

Manganese toxicity and tolerance of high manganese levels for subterranean clover growth showed out differentially between clover varieties on some soils from Albury.

Molybdenum deficiency was detected in the "Coal Measure" soil of the Clarence River area. This was consistent with the widespread lack of molybdenum in N.S.W. coastal regions.

Legume Nitrogen

Fallow nitrogen accumulation on arable soils at Tamworth was shown to be sufficient under some conditions to prevent significant fixation of nitrogen by cowpeas.

In a trial on the southern tablelands, the single-step legume seed lime pelleting method was shown to produce nodulation percentages and legume growth similar to the more expensive commercial three-step pelleting method.

Pasture Establishment Research

Rolling after Sowing.—A trial comparing establishment methods for subtropical species at Grafton showed that rolling after sowing had beneficial effects on the establishment of *Lotononis bainesii,* white clover and siratro.

Precision seed and fertilizer placement gave a further improvement with lotononis.

Types of Sod Seeder.—In a test with various types of sod-seeding machines, the conventional tyned sodseeder gave best results with large-seeded species such as vetch and cowpea; but the broad-cut sodseeder and the roto-seeder proved best for small seeds such as white clover and lotus.

Aerial Sowing.—This received special emphasis in tableland districts.

Micro-environmental studies at Canberra showed the need to kill existing vegetation by such methods as herbicide application, to obtain survival of sown pasture seedlings. Under herbicide treatment, lucerne survived as well as ryegrass.

Temperature, in the range experienced in the field at Canberra, was shown to be unimportant. Seedling cover was more critical.

Soil moisture was the paramount factor. High relative humidity in the micro-environment of the seed was found essential for surface sown seeds to germinate and establish satisfactorily.

Aerial agriculture remains a feature of tablelands pasture improvement. It has aslo been used increasingly this year on coastal areas and on the slopes. There was a trend towards ground spread of fertilizers in wheat belt areas, largely because of development of more effective ground-spread equipment.

"Chemical Seedbed Preparation".—This use of herbicides on existing pastures has been shown to be an effective method of preparation for sodsowing oats on the far north coast. Advantages on the soils of higher fertility were not as positive as on the red basaltic hill soils.

Pasture Seed Physiology Research

Seed physiology research at Canberra has shown that between 40 per cent and 60 per cent of subterranean clover seeds soften in 8 months under field conditions. The locus of softening is not confined to the strophiole of the seed. Percussion of hard seeds was shown to open the strophiole, allowing water penetration and subsequent germination. A minimum period of time under high temperatures (equivalent to warm days) was shown to be necessary for subterranean clover seed to soften.

In controlled temperature studies at Wollongbar, 8 tropical legumes germinated and made best initial seedling growth at temperatures between 70°F and 90°F. Temperatures above 90°F caused a severe drop in germination percentage, whilst those below 70°F retarded initial growth rates. Temperatures below 40°F virtually prevented germination.

Pasture Management Research

Temperate and Irrigation Areas.—The merit in using summer-growing irrigated pastures in Murrumbidgee Irrigation Area sheep breeding enterprise was studied at Leeton. Trial results have shown improved bodyweight increases and fertility advantages in the late stages of ewe pregnancy on such summer pastures.

On the south coast, at Berry, wool production gave promise of being a commercial proposition as a possible alternative to dairy or beef enterprises. Kikuyu grass carried 10 wethers/acre under a system of rotational grazing over a period of a year.

At Shannon Vale, management studies with the livestock-pastures combination have highlighted "superphosphate", "management system" and "stocking rate" as key factors governing sheep production and breeding performance on the northern tablelands.

At Cowra, a set-stocking grazing system killed out lucerne in a few months, whereas a decline of lucerne stand was slower under a rotational grazing system at similar overall stocking rates.

At Trangie, a 10-paddock rotationally-grazed lucerne stand produced 43.2 lb of wool per acre from dry ewes with only 10.7 inches of rain. In the second year stocked with breeding ewes, the area produced 34.4 lb of wool per acre—together with four merino lambs per acre—on 18.6 inches of rain. Set-stocking of the lucerne at two sheep per acre killed out the stand in 12 months while at five sheep per acre the stand was killed in seven months under this stocking system.

At Cowra, Condobolin and Trangie lucerne grazing trials have pointed to lucerne management principles which have application to extensive regions in the central west.

Subtropical Species.—In the Taree area, tests of grazing management techniques on subtropical legumes have established the desirability of leniency in grazing intensity; leaving the plant runners intact, preferably with 6 in to 12 in of topgrowth remaining. Regrowth through such management has been vastly improved compared with treatments involving more complete utilization.

Bloat.—In an agronomic study of the cattle bloat problem on the northern tablelands, deaths over a 6 years period averaged from 0.27 per cent in a dry year (1965) to 3.0 per cent in years of average or higher than average rainfall.

Bloat was clearly associated with clover dominance of improved pastures.

Experiments have been in progress for 2 years to study grazing effects on pastures with different legume percentages, and to achieve practical means of reducing the legume percentage at critical times of the year.

PASTURE EXTENSION, TRIALS AND DEMONSTRATIONS

U.P.S.E.T. (Uniform Pasture Survey and Extension Trials)

The 333 pre-packaged U.P.S.E.T. trials prepared for field use by agronomists this year included 93 trials on fertilizer use and 240 trials comparing pasture species and varieties. A continuing place has been demonstrated for these survey trials. They have continued over 10 years. In that time, material for 3,000 trials has been pre-packaged for field officers' use.

Numerous field days have centred on the U.P.S.E.T. trials, to survey the application of existing knowledge and provide demonstrations of favoured and recommended treatments in pasture improvement.

Pasture Demonstration Projects

District agronomists have used the Commonwealth Extension Services Grant during 1967–68 to set up demonstrations of new pasture cultivars and of recommended pasture establishment methods. Setting up of 52 pasture demonstrations was approved.

Species demonstrations have featured the role of the new phalaris varieties Sirocco and Seedmaster, the widespread adaptability of Kangaroo Valley perennial ryegrass, and the value of mixtures based on subtropical legumes and grasses on the far north coast. In particular *Lotononis bainesii*, *Setaria sphacelata* cv. Kazungula, and *Desmodium* species have been demonstrated.

Demeter fescue has been successfully demonstrated as a productive perennial winter-growing grass for the Cowra district.

Other demonstrations feature techniques of lucerne establishment on the south coast, and lime use on acid soils in the Goulburn district.

Feed Year Scheme

In the very successful North Coast Dairy Feed Year Assistance Scheme, near to 75 per cent of the farmers eligible used the scheme. Reductions in prices of subtropical legume and grass seeds facilitated its acceptance.

Successful field days were held on the whole-farm research farms on chocolate soils, conducted from Wollongbar Agricultural Research Station. Production on one of these farms has increased from 6,740 lb to 15,000 lb and on another farm from 10,060 lb to 13,300 lb of butterfat.

"Whole-farm" studies on Richmond River alluvial flats have also completed their fourth year, with outstanding improvements in production. Butterfat production in 1967–68 was 13,500 lb on each farm, compared with earlier base levels of 6,390 lb and 7,081 lb respectively.

These production gains were demonstrated with very little increase in herd size. Further production gains are expected when herd size is increased.

PASTURE SEED PRODUCTION

Drought effect on Tonnage

Tonnage Much Reduced.—The severe drought greatly reduced certified seed production. The total was 638 tons at 30th June, 1968, as against almost 2,700 tons certified for the year ended 30th June, 1967.

Subterranean clover cultivars' certified seed totalled 227 tons, including 220 tons of Dwalganup.

For Kangaroo Valley perennial ryegrass seed good spring rains on the south coast followed by a long dry period permitted a record harvest of 350 tons.

Demeter fescue provided 25 tons of seed, Seedmaster phalaris 17 tons and Broadleaf paspalum 4 tons.

Cancreep, the new creeping rooted cultivar of lucerne originated by the CSIRO has been released for seed production.

Changes in Certification Schemes.—Several changes were adopted in N.S.W. certification schemes, for closer conformity with the O.E.C.D. (Organization for Economic Co-operation and Development—Europe) varietal certification scheme for herbage seeds.

Establishment of new nomenclature and quality standards in seed certification has led to a better understanding between the plant breeder, seed grower and certifying authority. The changes were made possible by co-operation between the Department, the N.S.W. Seedgrowers' Association, the N.S.W. Seedsmen's Association and the N.S.W. Seed Increase Committee.

N.S.W. Herbage Plant Liaison Committee Influence.—This Committee has stimulated discussions affecting policy relative to registration, acceptance and release of new and old cultivars. Important steps were taken to perpetuate the genotype of cultivars and to make high quality basic seed stocks of both old and new cultivars available.

Imports and Exports of Seeds

Imports of pasture seed totalled 4,000 tons. About 30 per cent of this was red and white clover, mostly from New Zealand.

Seed of ryegrasses, couch and bent grasses also were imported, mainly from New Zealand. Bluegrass seed was purchased in large quantities from U.S.A.

Exports were very limited, as there was little available carryover subterranean clover seed. Overseas demand for seed was high. In the main, Western Australia satisfied the orders, because of the drought's affect on production in the eastern States.

Seed Certification Inspections

Approximately 20,000 acres were inspected and 21,000 sacks comprising 317 lines were paddock sealed.

Notes on Fodder Conservation

HAY

There has been a trend towards higher levels of hay production. This was set back by the drought conditions of 1967–68. There is also a change in the type of material used for haymaking; a notable increase in pasture hay as compared to lucerne and cereal hay. Lucerne, however, is still the most popular haymaking material. Cereals are slowly losing favour.

Hay storage forms also are changing. Sheaf or loose hay is now only about 2 per cent of the total.

Baling practices have not changed over the past 12 months except in the south west. There, interest in use of rolled or round bales has been considerable. Whereas rectangular bales are carted and stacked, the rolled or round bales are left in the paddock or merely carted to a corner of the paddock concerned and left unstacked there. The material is usually overgrown pasture grasses of fairly low feed value.

Two pelleting mills are in production in New South Wales, one at Singleton and the other at Forbes. These have been processing lucerne only. Production figures for this type of processed hay are not available. An estimate of their combined annual output is "about 10,000 tons".

Several individuals and companies have sought and been given information relevant to possible establishment of pelleting mills in various parts of New South Wales. Cost to establish such a mill would approximate $200,000.

There seems to be no interest in artificial hay drying.

GRAIN DRYING

Interest in grain drying has been maintained in all production areas. Firms catering for this trend have increased in number. Indications are that the percentage of the grain crop artificially dried is significant and increasing.

Most grain drying is practised in the wheat belt where both wheat and sorghum are dried. Some north coast farmers are drying shelled maize, for use as feed for dairy cows.

SILAGE

For 1967–68 the indications are that stocks and production of silage have been very low; possibly only 50 per cent of the 1966–67 stocks and production which totalled 519,000 tons. That total was the second from lowest for the past 6 years, but well above the long term average.

Many farmers, especially those running sheep, have indicated that they prefer grain and hay to silage. A common complaint about silage is the labour involved in getting it out of pits. This problem could be economically overcome by using machinery which is available for this work.

There has been no new trend in type of material ensiled, but more attention to the quality of material ensiled is apparent.

SCRUB FEEDING

During the drought in New South Wales some scrub feeding has been practised and a deal of publicity has been given to this aspect of drought management.

District agronomists made a survey of attitudes to scrub feeding. The answers generally did not favour the practice. Overall opinion was that whilst fodder trees of many kinds could be fed to stock with quite good results in the short term, costs were greater than if wheat were bought and fed.

It is noteworthy that not only Kurrajong and Wilga but box, iron bark, stringy bark and other euclaypts were also successfully used during the drought.

Seed Testing Laboratory

The Laboratory's work volume as measured by total of samples tested decreased by 8.2 per cent in comparison with the previous year.

Of the 2,784 samples received, some 490 were examined on behalf of the Commonwealth Quarantine Authorities and 1,000 in relation to Seed Certification Standards.

Pasture seed samples submitted for certification services decreased by 56 per cent, compared to the previous year, due to the drought. This lower commitment to seed certification services was partially offset by the submission of 180 samples of lucerne seed for analysis.

These lucerne samples, representing an estimated 300 tons of lucerne seed, were partly a result of an outbreak of dodder in a lucerne seed production area and partly a result of a record lucerne seed production season. Dodder seed was found only in four commercial lines.

The Laboratory continued to provide essential services in the maize, sorghum, cotton, rice, linseed, soybean, safflower, and vegetable seed production activities.

Tests and other assistance were provided to seed firms, boards, and statutory bodies, farmers, members of the public, the Police and Railways Departments and the Department of Customs and Excise.

Inspections Under Various Acts

The three inspectors continued, throughout the State, duties under the Agricultural Seeds Act, Stock Foods and Medicines Act, Pest Destroyers Act, Fertilizers Act, and Veterinary Surgeons Act. They visited 95 towns, made routine inspections of 467 stores and 148 special visits. In all they made 615 visits for inspections and in so doing took 145 samples. One prosecution resulted.

Unregistered products detected by them included 299 stock medicines, 74 stock foods, 18 pest destroyers, and six fertilizers. Warnings were sent to those responsible for marketing unregistered products in N.S.W.

The Inspectors were part time engaged on seed certification duties.

DIVISION OF HORTICULTURE

General

STAFF

Administrative Positions

The vacant Assistant Principal Fruit Officer (Extension) position was filled by Mr J. F. Johnson who subsequently was promoted to Principal Fruit Officer (Pome Fruits) on the retirement of Mr E. C. Whittaker. At 30th June, 1968, the Assistant Principal Fruit Officer (Extension) position was still vacant. Mr C. R. Turkington was appointed Acting Principal Fruit Officer (Viticulture), in the position vacated by Mr G. R. Gregory by promotion to Deputy Chief in the previous year. Mr R. Milburn was appointed Deputy Senior Inspector, Export and Import Branch to fill the vacancy occasioned by the death of Mr R. Howe.

Research Positions

There are four vacancies for research officers in the establishment of 22; one each at the Horticultural Research Stations, Narara and Dareton, one at the Agricultural Research Station, Bathurst, and one at head office. The vacancies, coupled with absence of officers on full time post-graduate studies, have particularly restricted research into stone fruit production problems in particular.

Three research officers are undertaking full time post-graduate study at Australian Universities for the degree of Doctor of Philosophy. Four more are working for Master's degrees as external post-graduate students.

Extension Positions

Although four officers were recruited to the extension establishment this year, there were three vacancies at 30th June, 1968, compared with two a year earlier. A new fruit officer (extension) position at Bathurst has been created and filled, using C.E.S.G. funds. This will enhance horticultural extension activities throughout the Western Agricultural Region.

Some District extension positions vacant for a long time have been filled; Batlow (vacant since 14–10–64), Mullumbimby (vacant since 7–3–66), and the Mid Murray (vacant since 7–1–63).

Regulatory Positions

Ten inspectors (Plant Diseases Act) were recruited but the net gain was only four. Vacancies still exist for two inspectors and one labourer in the regulatory staff establishment. A Port Macquarie District inspector (Plant Diseases Act) position has been created and filled, to improve regulatory services on the lower north coast.

Towards the end of the year approval was granted to create a new class of regulatory position to be known as Regulatory Assistant. The regulatory assistants will assist inspectors in policing the provisions of the Plant Diseases Act, and the Commonwealth Quarantine Act and Commerce (Trade Descriptions) Act. The new positions will widen the recruitment field and facilitate more efficient deployment of experienced regulatory staff. They will also provide a nucleus of staff in training for possible subsequent appointment as inspectors. There are eight vacancies for regulatory assistants.

Overseas Visits and Studies

At the invitation of the Department of External Affairs, Chief of the Division Mr R. G. Kebby visited Western Samoa under the auspices of ASPTAP. This visit was to investigate progress in the banana bunchy top control scheme to which Australia is contributing technical assistance and equipment. Mr Kebby also advised the Western Samoan Government on matters affecting the banana industry generally.

Officer-in-Charge of the Citrus Wastage Research Laboratory at Gosford, Mr J. A. Seberry, attended the International Citrus Symposium held at the University of California in March, 1968, to deliver by invitation a paper entitled "Comparison of various fungicides for the control of post-harvest rots of Australian citrus fruits". He then visited other citrus producing areas of the world to study recent research on post-harvest handling of citrus.

Research Officer Mr K. J. Scott visited New Zealand at the invitation of the New Zealand Department of Scientific and Industrial Research for work on the control of apple breakdown. He will return to New Zealand later in 1968 to assess the results. Mr Scott had also organized a long distance banana transport trial, Australia to New Zealand, applying the principles of modified atmosphere storage using polyethylene bags. Whilst in New Zealand he was able to examine the out-turn of this fruit. It was highly successful and stimulated considerable interest from scientific and trade personnel.

Senior Inspector Mr R. W. Robertson returned to Australia after 6 months in the United Kingdom and Europe where he temporarily held the position of Assistant to the Australian Fruit Officer, London.

Third Australian Fruit Research Conference

Eighteen officers of the Division of Horticulture attended the Third Australian Fruit Research Conference held in Mildura in June, 1968. Numerous papers were presented. A total of 113 delegates from all States and overseas participated. The conference, in accordance with a decision of the Standing Committee on Agriculture, is held every 5 years. The purpose is to review progress in fruit research and to develop liaison between workers in related fields from various research organizations throughout Australia.

Research for the Fruit Industries

RESEARCH—POME FRUIT INDUSTRIES

Rootstock Trials

Rootstock trials are prominent in the current research programme. Major interest is in the improved clonal Malling Merton range of apple stocks, because of the range of tree vigour produced, precocious bearing habits of some, and their resistance to apple woolly aphid attack.

Trials are at Bathurst, Glen Innes and Yanco Agricultural Research Stations, supplemented by several plantings in district orchards. Most are now in the eighth year and starting to yield useful production data. The trials will be under observation for a number of years but, in anticipation, steps have been taken to propagate the most promising of the stocks to provide a nucleus for future industry needs.

Apple Varieties Introduced from Overseas

Promising American strains of Delicious apples and local selections planted out as district trials in 1960 are now providing excellent demonstrational material for growers. Field days at plots in the Orange and New England districts have enabled growers to make "on the tree' assessments and comparisons with standard varieties. All of the imported Delicious strains have proved to be highly coloured and acceptable, but some concern has been expressed about the Starkrimson Delicious tendency to deep overcolouring.

Herbicide Trials

Herbicides are rapidly becoming an integral part of modern orchard management. Besides examining their effectiveness in weed control it is important to examine closely the behaviour of new materials in relation to tree health, within the various age groups, and to gather information on long-term effects of continual herbicide use in the orchard.

At Bathurst Research Station, herbicides are being used at varying rates in excess of standard recommendations. Bioassay determinations are being made towards establishment of soil residue safety limits for the various materials.

Pesticide Residues on Fruit

Samples of pome fruits were collected through the season and forwarded to the Chief Chemist to permit check studies of residue levels of various pesticides used. Additional samples, collected from various lines submitted by growers for export, were forwarded to Department of Customs and Excise to check on pesticide levels present on export fruit.

Hedgerow-Planted Apple Trees

Greater interest is being taken in closer planting in orchards, for efficiency of management. In this case they are close-planted apples on semi-dwarfing stocks. They increase yield per acre and reduce production costs

Planting Density

The question of optimum tree-planting distances for maximum yield *per acre* is increasingly important. There is widespread awareness that yield *per tree,* even of high order and acceptable quality, is not a satisfactory means in itself of measuring productivity. This has resulted in considerable interest in higher density plantings with somewhat greater establishment costs but lower production and management costs during the life of the orchard.

Unknown at present are the most suitable planting distances for the range of rootstock material currently being tested. To provide this type of information a trial involving a number of apple varieties and rootstocks was established in 1967 at Orange Research Station in 1967. Trees in this trial have been planted out at a minimum within-row interval of 6 ft, with progressively wider spacings (6 in increments) up to a 12 ft maximum.

Cool Storage of Apples

High moisture content is an important factor in relation to breakdown of apples in storage. The North Ryde Laboratory has established that there is decreasing incidence of breakdown in fruit subjected to increasing weight loss. Seemingly any treatment which speeds up the rate of loss of water from fruit without unduly ageing the fruit could be effective in reducing breakdown. Cool store relative humidities, and chemicals, are being examined as two methods of achieving weight loss. This year an officer of the Division is studying the effects of weight loss on breakdown under New Zealand conditions, where breakdown is usually more severe and where cool store facilities particularly suiting this type of study are available.

Growth Regulator Studies

Trials at Bathurst Research Station have so far shown compound G–996 to be highly effective in causing abscission of young fruitlets of the Democrat apple. Applied shortly after full bloom it caused fruit drop in proportion to concentration applied. However, as a chemical thinner at this stage it is without promise because of failure to produce adequate increases in fruit size.

The same compound is highly effective in promoting fruit fall when used as a pre-harvest spray. In this regard it could be useful as an aid to mechanical harvesting, in removing fruit intended for cider and other forms of processing, or entire removal of crops because of damage by pest, disease, hail, etc.

Fertilizer Treatments at Time of Planting

The practice of adding fertilizer to the hole at time of tree planting has not been recommended because of a history of damage when using conventional fertilizers. However, fertilizer mixtures available now are quite differently structured. Accordingly a trial was established at Bathurst Agricultural Research Station to determine the effects of incorporating varying levels of fertilizer mixtures into soil within holes at time of planting apple trees.

All of the five fertilizers tested gave growth responses in the first year. Generally, the response was greater at the time of $\frac{1}{4}$ lb per hole than at $\frac{1}{2}$ lb per hole. However, some treatments caused bark injury and long term effects will be looked for in subsequent years.

RESEARCH—CITRUS INDUSTRIES

Rootstock Evaluation

A series of rootstock trials established in the early 1960's at the Narara (Somersby Section) and Dareton Research Stations and the Yanco Agricultural College and Research Station, are beginning to provide valuable data. The outstanding features are:

Under Coastal Highland (700 *ft*) *Conditions.*—Both Troyer citrange and Cleopatra mandarin rootstocks have been outstanding in a new-land planting of Valencia oranges, whereas rough lemon and sweet orange rootstocks have performed poorly.

Under Similar Climatic Conditions but Old-land (*re-plant*) *Situation.*—Valencia oranges on *Poncirus trifoliata* rootstock are proving much more uniform and vigorous than those on rough lemon or sweet orange.

Under Inland Conditions Where Irrigation is Obligatory.—Both Valencia and Navel oranges growing on sandy soils at Dareton have shown the value of sweet orange and rough lemon stocks for these new-land conditions whilst *Poncirus trifoliata* rootstock has not been satisfactory.

At Yanco, on a Shallower Sandy Soil than at Dareton.—Rough lemon has been the most vigorous and productive rootstock, and Carrizo has been very satisfactory. The vigour of sweet orange rootstock has been a little erratic, and its overall performance has been intermediate between Dareton and Narara. By comparison with the other stocks, trifoliata has done better at Yanco than at Dareton.

Under Heavier Soil Conditions (*clay loam*) *in a Re-plant Situation at Yanco.*—*Poncirus trifoliata* and Carrizo and Troyer citranges have been outstanding rootstocks. Rough lemon did not establish under these conditions and Cleopatra mandarin has not done well.

Herbicide Management Evaluation

The value of herbicides in citrus soil management is being investigated at Narara (Somersby section), Dareton, and Yanco.

At Dareton, with Overhead Spray Irrigation.—A totally bare surface obtained by applying diuron both in spring and autumn is being compared with diuron in spring plus winter cover crop, and with normal clean summer cultivation plus winter cover crop. The complete diuron treatment has been outstanding. It has been associated with higher yields in the two crops since the trial began, excellent tree health (no signs of herbicide injury) and no noticeable adverse effects such as scouring of the bare surface or decreased water penetration.

At Yanco.—Bromacil and latterly terbacil have given the best results, both on heavy loam soil with furrow irrigation and on shallower sandy soils with overhead spray irrigation. Initially, diuron did not control the variety of weeds present but repeated application and higher rates indicate that it will be quite satisfactory.

At Somersby.—Under coastal highland climatic conditions and light shallow sandy soils, bromacil has again been very satisfactory in the early stages and diuron appears to hold some promise.

In each of those trials the herbicides have been applied at rates from 2 lb (light soils) to 4 lb (heavy soils) of active ingredient (a.i.) per sprayed acre in the initial stages, with decreasing concentrations after the first few applications. In a high rate trial at Dareton and Somersby no phytotoxicity has been observed on trees where diuron and bromacil rates were as high as 10 lb a.i. per acre.

Close Planting of Citrus

At Dareton in a specially designed close planting trial Valencia orange trees double planted (24 ft x 12 ft) in 1960 are still producing slightly more than twice the crop per acre compared with the normal spaced (24 ft by 24 ft) control trees, even though the individuals in the latter group are slightly bigger trees than those in the close planted section. Fertilizer and irrigations have been applied on an acreage basis.

This trial has been planned to allow for several thinning or pruning treatments over the life of the planting. The first of these will be incorporated this year.

In another trial at Yanco, close planted (17 ft x 7 ft 4 in) five year old dwarf navel orange trees have yielded 350 bushels/acre in their first crop year as against 130 bushels/acre for trees planted at conventional spacings.

Mould Wastage During Storage

Application of Post-harvest Treatments.—In storage trials at the Gosford Citrus Wastage Research Laboratory, sodium ortho-phenylphenate (SOPP), 2-aminobutane (2AB) salts and thiabendazole (TBZ) have been compared. Both 2AB and TBZ proved more effective against green mould (*Penicillium digitatum*) than did SOPP in early stages of infection. Because 2AB salts are water soluble and TBZ is not, 2AB would seem the more suitable alternative fungicide to SOPP for use in packing house soak tanks.

In other trials a single treatment of TBZ, dried onto the fruit following washing, proved to be at least as effective as the double SOPP treatment for green mould control and has also shown promise in the control of stem-end rot. A combination of 2AB in the soak tank, and TBZ dried on, would appear to be promising for commercial application provided these substances are approved by health authorities.

Effect of Fertilizer Practice.—Navel oranges from a nitrogen nutrition trial at Yanco were stored for several weeks to assess whether field treatments would influence mould breakdown. The results showed that high nitrogen fertilization (8 lb sulphate of ammonia/tree/annum) increased mould wastage during storage, in comparison with lower levels (4 lb). The application of superphosphate (24 lb) together with the high level of sulphate of ammonia (8 lb) reduced mould wastage.

Application of Growth Substances

In a number of small trials the following observations have been made on gibberellic acid (GA) effects on citrus.

GA, and to a lesser extent 2,4-D, reduced "puffing and creasing" in Valencia oranges in 1966. But no effect was noted when the trials were repeated in 1967. Both materials increased fruit size in 1966, but again no effect was noted in 1967. Possibly the time of application is critical. Treatments in 1966 were applied 2 weeks earlier than those in 1967.

Both GA and 2,4-D accelerated the rate of regreening, 1966 and 1967. GA was much worse than 2,4-D in this regard.

Fruit size of Ellendale mandarins was increased by GA and by 2,4-D applied in July or August. In this respect there appeared to be no difference associated with application times.

Citrus Parent Tree Block, Dareton

Nucleus plantings were made in 1967–68 to establish a citrus parent tree block at the Horticultural Research Station, Dareton. The object is to provide a citrus bud certification scheme in co-operation with the N.S.W. Citrus Bud Selection Society. The planting at Dareton will include all popular varieties being propagated by nurserymen, and will be densely planted in order to gain a maximum production of budwood from a minimum area.

All budlines have been screened by the Biology Branch for serious virus conditions. They will be grown on trifoliata rootstock and regularly inspected to guard against mutations and other off-type characteristics.

The project will be a quasi-commercial venture. All of the budwood will be distributed and sold through the Bud Selection Society.

The project is expected eventually to meet all the citrus budwood requirements of nurserymen in N.S.W. and will make a substantial contribution to the industry through improvement of budlines.

RESEARCH—TROPICAL FRUIT INDUSTRIES

Banana Nutrition

Field Nutrition Trial.—This trial at the Tropical Fruit Research Station, Alstonville is being finalized and the data statistically examined. There will only be limited information from it on responses to applied fertilizers. But valuable experience peculiar to bananas has been gained in experimental procedures.

Preparations have been made to investigate nutrient relations using sand culture techniques in a large pot culture trial. A technique for micro-bud propagation has been developed which will produce plants of low nutrient reserves and so overcome some of the variables in banana nutrition experimentation.

Magnesium.—Two field trials have been established on magnesium deficient soils. In one trial, application of dolomite at rates of 0 to 32 lb per plant is being examined. In the other the efficiency of various magnesium carriers for correcting magnesium deficiency is being tested.

Potash.—Potash deficiency investigations are continuing on the chocolate basalt soils west of Lismore. Deficiency symptoms have been reduced by potash applications of up to 16 lb per plant, but this has not been reflected in higher levels of potassium in the leaves.

Phosphorus.—Relationship between leaf and soil phosphate contents is being investigated in association with the Chemistry Branch. The role of phosphate in banana nutrition is not fully understood. From observations it is postaulated that certain fractions of soil phosphate are unavailable to the plant.

Banana Plant/Soil Moisture Relationships

Yield increases of up to 50 per cent have been obtained at the Alstonville Tropical Fruit Research Station from treatments based on specified soil moisture regimes, as compared with natural rainfall.

From investigations to determine when irrigation is needed, it so far appears possible to decide irrigation schedules from evaporation data (evaporimeter). Such a method is far simpler and easier than determining soil moisture by physical means or by using meters.

Plant physiology aspects in relation to irrigation are also being investigated, including the effects of soil moisture stress at various stages of plant growth. Harvests of whole plants are being made to examine these effects on plant weight, plant height, and bunch differentiation.

Banana Variety Introductions

The Jamaican variety Bodles Anteforte, and strains C, N and S of Cavendish which were selected by the Queensland Department of Primary Industries, were introduced to Alstonville from Queensland for observation. The variety Valery was introduced from Kew Gardens, England, and is currently growing in quarantine. Valery was bred in Boston by the United Fruit Company and is under test by that organization in Jamaica as a variety to replace Gros Michel. It is similar to the Australian giant Cavendish varieties Mons Mari and Williams.

Banana Transport in Polyethylene Bags

Long distance transport trials have confirmed earlier work with polyethylene bags. Bananas respond well to this type of controlled atmosphere storage. Inclusion of an ethylene absorbent in the bag further delayed ripening and enabled fruit to be held in a hard green condition at ambient temperatures for several weeks.

Treatment of hands of fruit with thiabendazole prior to packing was very effective against development of rot due to *Gloeosporium musarum.* Health authorities' approval to use thiabendazole in Australia has not yet been given but it was recently approved in the U.S.A. for use on bananas.

Banana Maturity

Research at the Tropical Fruit Research Station, Alstonville has been directed toward defining an index of maturity for harvested fruit, to enable extinction of transport/storage life. Use of heat units has proved impracticable, due to variable response of the fruit per unit of heat at different stages of plant development and at different times of the year.

A chemical index in which changes in the leucoanthocyanin content are measured was shown to be of no more value than physical parameters, and too complex for field use. Fruit diameter is as reliable as the chemical index and is easier to apply.

Earlier harvesting ("cutting back"), although desirable in restricting "mixed ripe" in bananas, is uneconomical in practice. The trial has been terminated.

Sterilization of Bananas for Fruit Fly

The initial experiments at Gosford Citrus Wastage Research Laboratory with ethylene dibromide (EDB) fumigation of bananas artificially infested with larvae of Queensland fruit fly provided data for a dose rate-mortality probit line. From this, it was estimated that a dose rate of about 15 oz EDB per 1,000 cu ft at 70° F would give mortality equivalent to probit 9.

Following preliminary surveys of fruit injury a large scale survey showed that 14 oz 1,000 cu ft at 70 deg. F was the highest dose which did not cause injury or adversely affect ripening. An extensive series of fumigations at this dosage has resulted in a total of 58,778 larvae killed—with one survivor. A second series of tests with fruit containing fruit fly eggs has not been completed, but so far results indicate that eggs are less susceptible to fumigation than are larvae and that survival is slightly higher.

In experiments with insecticidal dips, using 0.03 per cent dimethoate a total of over 57,000 larvae in artificially infested bananas have been killed—with one survivor. Reducing the dip time from three minutes to ten seconds has not decreased its effectiveness. Tests are in progress with fruit containing, at the time of dip treatment, eggs rather than mature larvae. Addition of sodium salicylanilide or thiabendazole to the dimethoate dip appears to slightly reduce the effectiveness of the insecticide, particularly at concentrations lower than 0.03 per cent dimethoate.

Macadamia Nut Propagation

Propagation techniques for macadamia nuts are being developed at the Research Stations at Narara and Alstonville. Seed grafting continues to show promise but a problem is fungal attack on the germinating seed. Seed dressings with a range of fungicides are under test. Chip budding of nursery stocks has been shown to be a useful and fairly reliable method of propagation.

Passionfruit Selections and Hybrids

A trial planting of local selections, and hybrids developed in Queensland, has been established for observation. The field performances of the hybrids 3–1 and 3–26 on *P. edulis f. flavicarpa* have been impressive in regard to cropping. But their acceptance on the fresh fruit market has not been as good as the full purple-skinned strains of *P. edulis*. The trial will compare the performance of some selected strains of *P. edulis* as alternatives to the hybrids.

RESEARCH—GRAPE INDUSTRIES

Pruning, Training and Spacing of Wine Grapes

At Griffith Viticultural Research Station, data were collected for the second year from a series of pruning, training and spacing experiments planted in 1962.

Black Shiraz.—As in the previous vintage, T-trellis gave higher yields than the standard single wire trellis. The data for 1967 and 1968 are being statistically examined by computer analysis in several ways, seeking more information than can be obtained with conventional analyses. Increased yield associated with T-trellis has been shown to be not only a function of bud number but probably also of bud fruitfulness.

Semillon.—Again, as in the previous year, vines trained on T-trellis yielded more fruit than those trained on a single wire trellis. Vines pruned to rods yielded more than those pruned to spurs. In fact vines pruned to rods on single wire trellis outyielded those pruned to spurs on T-trellis.

Gordo Blanco.—As in 1967, training on T-trellis gave slightly higher yields than on single wire trellis and, on an acreage basis, vines planted 4 feet apart in the rows again substanitally outyielded those planted 7 feet apart. Vines planted 4 feet apart filled the whole trellis length with foliage, vines at the wider spacing only partially filled the trellis.

Irrigation Frequency and Timing

The study of effects of frequency and timing of irrigation, on yield and quality of Black Shiraz wine grapes, continued into its second season at the Griffith Station. Moisture stress imposed during January and February, 1968 greatly reduced berry size and leaf and shoot growth, increased the skin colour and hastened maturity. A method to estimate moisture status of the vine was evolved, based on determination of leaf relative turgidity.

Radiation Environment

A theoretical model is being developed at Griffith Viticultural Research Station to determine sunlight interception in vineyards with varying planting patterns and trellis arrangements.

Variables being analysed are row spacing, trellis height and width, vine width, angle of inclination of canopy sides, azimuth of rows and solar radiation factors. The model is being analysed by computer. From this it should be possible to estimate optimal planting distance and trellising arrangement for vines in any environment.

Wine and Table Grape Variety Improvement

Nine recently introduced white wine grape varieties were established in a variety trial at the Griffith Station, to test for yield and quality under M.I.A. conditions. The area will be expanded as planting material becomes available from the other 49 varieties and clones already introduced.

Selected High Yielding Sultana Clones

Five high yielding sultana clones selected by the CSIRO are being compared with a planting of unselected vines, at Dareton Horticultural Research Station. In the first two years of cropping the yield average of the selected clonal vines has been 25 and 51 lb per vine, compared with 21 and 39 lb for the unselected vines.

Phylloxera-resistant Grape Rootstock Trials

Two rootstock trials on properties in the Campbelltown district are showing interesting results. The scion in both trials is Black Muscat.

At Orchard Hills, rootstock 106.8 produced good yields of well coloured fruit and was decidedly superior to the more commonly planted du Lot. While producing lower yields than 106.8 rootstock, 3309 produced early maturing high quality fruit.

On the sandier soils at Chipping Norton the pattern was similar, but Montpellier performed very well and was only slightly inferior to 106.8.

Gibberellic Acid to Improve Table Grape Quality

On a Wedderburn property excessively tight bunches of Black Muscat were thinned and loosened by sprays of 1 ppm gibberellic acid (GA) applied at the end of bloom. Bunch rot incidence was almost eliminated, berry colour was improved and the loose bunches were easier to pack.

At Orchard Hills 20 ppm GA applied at full bloom reduced the incidence of "hen and chicken" and of bunch rot in Waltham Cross.

Storage of Grapes

Methods of packing Waltham Cross grapes for cold storage were further investigated at Griffith and North Ryde.

After 8 weeks storage, the Paulin pack using polyethylene bags and polyethylene sachets of metabisulphite solution was decidedly superior to other packs tested. The outstanding feature of this pack was the fresh green condition of the stems.

After 12 weeks storage, excessive berry shatter and moisture accumulation detracted from the Paulin pack. The results were slightly inferior to the South African export pack using bunch wraps and sulphur dioxide tablets, and to the standard Australian export pack using granulated cork packing. Best results for the longer storage period were from the South African pack.

RESEARCH—STONE FRUIT INDUSTRIES

Stone Fruit Variety Introductions

A large number of canning and dessert peach varieties introduced from interstate and overseas sources has been released from quarantine and are now well established in trial plots at Yanco Agricultural College and Research Station, Bathurst Agricultural Research Station and Narara Horticultural Research Station, for evaluation with locally selected strains.

Some yellow fleshed nectarine varieties introduced from overseas were released from quarantine and have been propagated for a trial at Bathurst.

Budwood of seven additional peach varieties and five nectarine varieties were introduced from the U.S.A. in 1968 and are now under quarantine before release for trial purposes.

Variety Trials—Dessert Peaches

The 1967–68 season provided conditions for the first comprehensive evaluation of all the peach varieties contained in plantings made in 1961, 1962, and 1963 at the Bathurst Station. Valuable records were made of tree growth, time of blossoming, amount of blossom, and nature of fruit set. The fruit was harvested under very favourable conditions enabling precise measurements of total yield, fruit numbers, size, and quality. The quality characteristics of each variety were assessed in detail both at the stage of commercial picking maturity and again after storage at both room and cool store temperatures.

The considerable data obtained have been prepared for statistical analysis on the computer. The results will provide a basis for preliminary recommendations concerning the suitability of each variety. Indications so far are that the very early maturing Maygold and the midseason Loring, each a yellow fleshed peach, will prove useful additions to the present range of dessert varieties.

Variety Trials—Canning Peaches

Information collected from the canning peach trials at Yanco will be useful to assess further the varieties being tested, although the crop was light and affected by hot weather. Trees have been raised to establish district plots of promising mutant strains of Golden Queen.

Variety Trials—Apricots

Testing of apricots selections is continuing at Yanco in a trial wherein Victorian and local selections are being compared with Trevatt and Morocco. Samples of all varieties under test have been canned for evaluation of canning quality.

Variety Trials—Cherries

Drought conditions at Young affected cropping in cherry trials this season. No useful observations could be made on fruit quality. It was noted, however, that Merton Heart trees defoliated early because of the dry conditions. Consequently they were less affected by the drought than were other varieties.

Rootstocks for Stone Fruit

Testing of rootstocks for major stone fruit crops continued. Established trials with peaches, prunes. plums, cherries, and apricots are all providing valuable information for the industry.

Use of plum rootstocks for peaches and apricots is receiving special attention in a trial at Bathurst, in an effort to obtain resistance to root rot. Although the trees are only 3 years old, growth of peaches on Brompton plum has so far been comparable to the standard peach seedling rootstock.

Trees have been propagated to test the value of Buck plum as a rootstock in the M.I.A. for apricots.

A trial to study the interaction between rootstocks and virus infection in cherries has been established at the Orange Agricultural Research Station. Previously planted trials in the Orange district have demonstrated the resistance of F12/1 seedling rootstocks to bacterial canker.

Chemical Thinning of Peaches

A new compound (G–996) was tested at the Bathurst Station as a chemical thinning spray for peaches. Its ability to cause abscission in young fruitlets was demonstrated on several varieties. But its value under commercial conditions is doubted because of inadequate increases in fruit size and the sensitivity of at least one variety to foliage injury.

Post-Harvest Control of Brown Rot

Thiabendazole effectiveness against *Sclerotinia fructicola* was confirmed. Various concentrations of the fungicide were studied and a research paper is being prepared. Some residue data were obtained with thiabendazole on peaches and cherries.

Six other chemicals were screened for effectiveness and one ("1991") showed excellent control of *Sclerotinia fructicola*. None was effective against *Rhizopus* sp.

Hot water dips were effective in controlling rotting but critical temperatures and duration of dip need closer evaluation to avoid fruit injury.

Peach Tree Nutrition

In the third year of a trial at Yanco, canning peaches fertilized with anhydrous ammonia produced 30 cwt per acre more than did trees receiving the same quantity of nitrogen in the form calcium ammonium nitrate. Fruit size in the anhydrous ammonia plots was also slightly better. No differences had been apparent in the first two years of the trial.

Deciduous Fruit Tree Improvement Scheme

Inspection of parent trees to be used by nurserymen as a source of budwood continued to effect an improvement in type of tree produced for commercial plantings.

Following detection of virus diseases in peaches in the M.I.A., check inspections were made for presence of virus symptoms in peach orchards. Specimens were submitted to the Chief Biologist for screening. Initial field screening work has been undertaken also in the Research Station nurseries at Bathurst and Narara, and arrangements are in hand for a complete survey of peach orchards in the M.I.A. in the 1968 spring.

RESEARCH—STRAWBERRY INDUSTRY

Strawberry Breeding

New Variety "Narabelle".—The breeding programme continued. In 1967–68 fifteen selections were made from 1,800 seedlings raised from 36 crosses at Narara. Previous selections were further tested at Narara and Hawkesbury Agricultural College. A variety released for testing in district trials has been named Narabelle.

Virus-free Stock.—Plants produced from heat treated virus free material of the varieties Kendall and Nared have been raised in isolation at Somersby. These will be distributed to runner growers in 1968–69. Raising of virus free stock for production of plants will continue.

TILE DRAINAGE RESEARCH

Depth and Spacing of Tile Drains

Agronomic responses of citrus, grapes, and peaches to various depths and spacings of tile drains are being studied at the Griffith Viticultural Research Station. This season, no critical water tables were experienced and so no responses to drainage treatments were obvious.

The experimental area received an application average of 25.6 in of irrigation water, plus 12.2 in of rain. Of this, 1.82 in (4.8 per cent) was intercepted by the tile drains. The interception was of similar order to that in the previous year, i.e., less than 5 per cent (*not* "less than 50 per cent" as incorrectly appeared in last year's annual report).

This season each crop was irrigated with a view to satisfying its needs and of maintaining a constant water table level. From November to February, peaches with a foliar coverage of about 45 per cent of the soil surface used six surface inches per month. Vines and citrus, with foliar coverages of about 30 per cent and 15 per cent, used about 3½ and less than three surface inches per month respectively.

Lysimeter Studies

By withholding water from trees previously subjected to various water table levels, it was found that trees previously subjected to one foot water tables showed stress much sooner than did trees that had either been fully drained or with water tables at 5 feet. The latter showed stress slightly sooner than did trees that had been subjected to 3 days of waterlogging at fortnightly intervals, but otherwise fully drained, before the water was withheld.

District Observations on Tile Drainage

A survey of tile drainage effluent salinities in the Murrumbidgee Irrigation Area has shown a general decrease over the past 5 years.

Research Stations and Laboratories

ALSTONVILLE TROPICAL FRUIT RESEARCH STATION

A large outdoor pot experimental area comprising 40 in x 48 in reinforced concrete pots was completed for banana nutrition work. New plantings of pineapples were made for short term experiments. An area of papaws was established for selected work. Passionfruit selections on *P. flavicarpa* rootstocks were planted for field assessment.

The banana post-harvest research programme under the Banana Research Advisory Committee was recommenced with the appointment of a research officer.

An order has been placed for supply of a controlled environment chamber, for growth studies of banana plants.

BATHURST AGRICULTURAL RESEARCH STATION

Recommendations for the further development of the research programme were formulated. These followed a review of work in hand and of research needs of the deciduous fruit industry, at a conference at the Station.

Minor improvements have been made to the temporary laboratory facilities and some additional equipment has been purchased, but improved laboratory facilities are needed for the expanding research programme.

DARETON HORTICULTURAL RESEARCH STATION

Permanent overhead irrigation sprinklers were installed to a further 40 acres. The total reticulated for irrigation is now 92 acres. Tile drainage works were installed in the stone fruit and viticulutral areas and to some citrus. A tile drainage installation was also made for the citrus nutrition trial to be planted in the 1968 spring. Construction of a 60 ft x 25 ft glasshouse, with evaporative cooling, was completed.

A zinc spray trial was initiated to compare spring and autumn applications of zinc sulphate and zinc oxide as controls for zinc deficiency and to observe effects on residue, regreening and fruit quality.

GOSFORD CITRUS WASTAGE RESEARCH LABORATORY

Co-operative investigations with the CSIRO Division of Food Preservation continued. New projects started include the post-harvest handling and treatment of mandarins, evaluation of new methods for application of the most promising new fungicides for wastage control, and investigations of brush units for cleaning citrus fruits.

New equipment installed included an Ultra Violet sterilizer, inoculation cabinet, and a controlled temperature chamber for the dual purposes of banana ripening (fruit fly sterilization investigation) and citrus degreening.

GRIFFITH VITICULTURAL RESEARCH STATION

Nine wine grape varieties established in a variety trial were trellised, and planting material of six other recent introductions have been propagated to extend the investigations.

Construction of a 45 ft x 30 ft glasshouse was completed. A tender was let for construction of a root chamber to enable studies on vine root physiology. New equipment included a mechanized soil sampling unit, and a centrifuge.

NARARA HORTICULTURAL RESEARCH STATION

A 15-acre area cleared on the Somersby section for further extension of citrus investigations was cross-ripped and cleared of roots. Clearing of an adjoining area of pine trees to permit effective irrigation and sub-soil drainage of the block as a whole was deferred pending a decision by the Department of Main Roads on the effects of their planned expressway. Plans now indicate that the expressway will skirt the area. Therefore the clearing and development will proceed.

New citrus projects commenced this year include herbicide management trials, zinc deficiency spray trials, and gibberellic acid investigations on navel oranges. Citrus Improvement Committee projects included extension of stem pit investigations, stubborn and greening investigations, and the testing of Smooth Seville x trifoliata hybrids as rootstocks. These projects involved the planting of 783 trees.

A plot was established at Somersby for multiplication of virus-free strawberry plants for distribution to runner growers.

Development of an area for permanent establishment of deciduous fruit trees virus indexing material continued.

New equipment acquired included offset and rear herbicide booms and two miscroscopes.

NORTH RYDE FRUIT PRESERVATION RESEARCH LABORATORY

Fruit storage investigations were continued in co-operation with the CSIRO Division of Food Preservation. A gas chromatograph unit designed to measure extremely low concentrations of ethylene has been tested. It is now in operation to study ethylene effects in relation to the ripening of bananas.

ORANGE AGRICULTURAL RESEARCH STATION

The first plantings for fruit research were made in the 1967 winter. Research to be conducted will relate to: hedgerow planting of apple trees, involving investigation of various rootstocks and tree spacings; elucidation of the cause of a decline condition within cherries; growth retarding and growth promoting hormones; and the effects of cultural treatments on fruit behaviour in cool storage.

YANCO AGRICULTURAL COLLEGE AND RESEARCH STATION

Horticultural staff moved into the renovated building providing improved office and laboratory accommodation.

Crop handling facilities have been further improved with the purchase of a fork lift truck. Installation of a new pumping unit in the orchard sprayer has helped to improve spraying efficiency. A single 29 in slotted plastic drainage lateral was installed to drain a citrus area showing a localized high water table.

A further herbicide management trial was superimposed on the "Close Planting of Dwarf Orange Tress" trial.

Committees Affecting Research

Co-ordination of Fruit and Vegetable Processing Research

This Committee, comprising representatives of the CSIRO, Department of Agriculture, University of N.S.W. and the canning industry met twice this year. Internal breakdown of processed apricots and the dehydration of prunes received special attention. A sub-committee was formed to examine further the apricot breakdown problem.

Canning Fruits

The N.S.W. section of the Australian Canning Fruits Advisory Committee met in July, 1967, to formulate canning fruits planting policies in the M.I.A. At this time difficulties were being experienced in disposal of carry-over stocks of canned fruits and the Committee considered caution to be the immediate need concerning expansion of plantings. Another meeting is to be held shortly, reviewing the matter in light of changes in the canning industry situation brought about by devaluation and other developments in the past year.

Spray Residues

The Spray Residues Committee was set up under the authority of the Department of Primary Industry to investigate and if necessary evolve methods of removal of toxic residues from export fruit, particularly apples and pears. The Committee employs a full-time analytical chemist and assistant attached to the Chemistry Branch. In the past season samples of pome fruits sprayed with various pesticides were forwarded to the chemist for residue analysis.

Deciduous Fruit Tree Improvement

Comprised of representatives of the Division of Horticulture and Biology Branch, this Committee aims to prevent by selection of propagating material the spread of virus diseases in deciduous fruit trees. Locations of selected parental trees have been recorded. Nurserymen are referred to these to obtain supplies of budwood. Selection has been mainly on apparent visual freedom from virus diseases but the ultimate is to provide a source of tested and known virus-free material.

The virus position in respect of canning peaches in the M.I.A. received special attention this year.

Vine Improvement Research

This Committee advises and assists the CSIRO in its grape research programme. The annual meeting was highlighted by the presence of Professor N. Shaulis of Cornell University, U.S.A. He had spent a year in Australia, based at the CSIRO's Merbein Research Station. There he initiated a trial investigating various sultana pruning and training systems, including one suiting mechanical harvesting. At the meeting he gave his impressions of Australia's viticultural research needs.

Citrus Improvement

The Citrus Improvement Committee met twice to discuss current and future programmes, and to inspect field projects. The Committee comprises senior officers of the Biology Branch and Division of Horticulture active in citrus improvement research programmes. The main objectives are firstly to gain full appreciation of the various virus complexes affecting citrus, and secondly to improve budlines and rootstocks for commercial use. The Committee now control some 30 projects. Most of these involve exhaustive virus screening, special propagations, and finally field trials.

Citrus Wastage Research

This Committee met twice, at the Citrus Wastage Research Laboratory, Gosford, to review progress in the research programme and other activities at the Laboratory. The Committee comprising representatives from the Department of Agriculture and the CSIRO Division of Food Preservation expressed satisfaction with the progress, particularly with respect to the testing of promising fungicides, including 2-aminobutane and thiabendazole, and the publication of research results. A 1968–69 research programme was approved. Recommendations were made for purchase of plant to investigate spray waxing of citrus and fungicidal bulk treatment of citrus.

Citrus Survey

A special Citrus Survey Committee was convened following a meeting between the Executive Research Panel of the M.I.A. Irrigation Research and Extension Committee (I.R.E.C.), the Department of Agriculture, and the CSIRO, to investigate the poor growth of citrus in the Cudgel and Coleambally irrigation areas.

The investigating Committee, comprising representatives from the Department of Agriculture, CSIRO and W.C. & I.C. surveyed citrus orchards at Cudgel, Coleambally and Kooba in August, 1967. Although the farms were developed by experienced citrus growers rehabilitated from undrainable properties in the M.I.A., the Committee was able to determine a complex of cultural and managerial problems responsible for the poor growth.

The report and recommendations were presented to and adopted by the annual meeting of the I.R.E.C. As a result, the Department of Agriculture intends to develop a demonstration citrus orchard at Cudgel incorporating these recommendations.

Murray Citrus Sub-Committee

The Murray Citrus Sub-Committee of the Co-ordination Committee for Fruit and Vegetable Storage Research held its annual meeting at Renmark in South Australia. Delegates to the meeting represented the N.S.W., South Australian, and Victorian Departments of Agriculture, and the CSIRO Division of Food Preservation. The Committee reviewed post-harvest storage and related research conducted over 12 months by the member organizations.

The meeting concluded from evidence presented that excessive occurrence of rind injury to Navels, Valencias, and mandarins in the Murray River areas was largely a result of harvesting and handling injuries that could have been avoided.

M.I.A. Irrigation Research and Extension (I.R.E.C.)

The I.R.E.C. annual meeting was attended by representatives from the various Divisions of this Department, the CSIRO, other State organizations, Trading Banks, Industry and growers. The main activity of I.R.E.C. is co-ordination of research and extension activities in the M.I.A. The I.R.E.C. also undertakes a biennial census of fruit tree plantings. The aerial re-survey of plantings was carried out in November and the ground survey was completed by April.

Divisional officers were delegates at the Horticultural Sub-Committee meetings of I.R.E.C. which this year recommended further activity with spray machinery, bulk handling, and mechanical harvesting.

Central Coast Agricultural Research and Extension (C.C.A.R.E.C.)

The C.C.A.R.E.C. aims to co-ordinate research and extension in the Gosford/Wyong districts in a similar manner to the I.R.E.C. in the M.I.A. It produces a bi-monthly extension newsletter with contribtuions from Departmental officers. This Committee was most active in organizing field days and demonstrations on herbicide management, mechanization and other advances in citrus orchard management.

Banana Research

The Banana Research Advisory Committee meets annually to review the post-harvest banana research programme being carried out in the Tropical Fruit Research Station, Alstonville, the Hamilton Research Laboratories in Queensland, and the CSIRO Laboratories at North Ryde. It comprises representatives of the Commonwealth Department of Primary Industry, the States of New South Wales and Queensland, the Australian Banana Growers Council and the CSIRO. Funds are contributed by the industry and the Commonwealth.

At its annual meeting, the Committee recommended particular attention to investigations of ripening procedures and packaging. The Committee sponsored a conference of technical officers concerned with post-harvest research in bananas. The conference enabled valuable discussion on the progress and future programmes of projects relating to market diseases, packaging, the mixed ripe problem, ripening, transport, antifungal substances and ethylene measurement and production.

Banana Fresh Fruits Disinfestation

This Committee comprises representatives of the Commonwealth Department of Primary Industry, CSIRO, and the State Departments of Agriculture of New South Wales, Queensland, Victoria, and South Australia. Finance for the current 3-year programme of research is provided by the Australian Banana Growers' Council, State Departments of Agriculture, and the Commonwealth to investigate the sterilization of bananas against Queensland fruit fly at the Gosford Citrus Wastage Research Laboratory.

Banana Beetle Borer Control

The Beetle Borer Control Committee comprises representatives of the Banana Diseases Control and Development Co-operative Ltd, and the N.S.W. Department of Agriculture, with funds provided by the Co-operative. Its objectives are to confine and control banana beetle borer in the southern areas of N.S.W. and ultimately to eradicate the pest. Technical direction of the campaign is the responsibility of the N.S.W. Department of Agriculture.

Extension Services to Fruit Industries

GENERAL

Targets for Achievement and Programme Planning

Adoption of targets for achievement has resulted in better planning and a more purposeful approach to the extension activities of the Division of Horticulture. Prior definition of objectives has permitted a better evaluation to be made of the success or failure of extension projects. Some 30 of a total of 34 primary extension targets were successfully completed, although the result in six cases was affected by factors outside the control of the Division.

Following the introduction of targets for achievement accent has been placed upon the need for wider adoption of programme planning in extension activities. This is perhaps the major feature of the past year. All District officers have been required to make situation analyses within their district and to work towards the solution of major problems.

Staff Training

The four Extension officers recruited in 1966, four in 1967, and four in 1968 have been attached to horticultural research stations in supernumerary capacity to expedite their training. Action has also been taken towards increasing the time spent by young officers in Regions, away from their established headquarters, to gain wider field and administrative experience. With more intensive training, most extension recruits will be able to assume full responsibility for a District position in 3 years from appointment instead of the 5 to 6 years previously needed.

Prompted by the big proportion of young fruit officers within the Division, arrangements have been made to hold a special school in August, 1968, for detailed instruction in administrative procedures and technical aspects of horticultural extension work.

EXTENSION ACTIVITIES OF SPECIAL INTEREST

Chemical Weed Control in Citrus Orchards

Successful extension campaigns were conducted at Gosford and in the Murrumbidgee Irrigation Area and the Lower Murray District to encourage wider adoption of herbicide management techniques in citrus groves. Field days and demonstrations highlighted the degree of skill required in chemical weed control and citrus growers were encouraged to attempt only small areas at first.

Fruit growers have accepted the challenge of this new form of soil management. Adoption has been very rapid, particularly in the Lower Murray District where there is less variation in soil type. Despite more variable soil and weed conditions elsewhere, throughout the State good results have been achieved. But there is need to continue research and extension with respect to selecting and using chemicals which can be toxic to fruit trees in certain circumstances.

Drag-hose Irrigation

Under-tree sprinkler irrigation by the drag-hose system has obvious economic advantages for supplementary irrigation. It gives better distribution and utilization of limited water supplies, with reduced capital outlay. A demonstration plot has been established at Hawkesbury College. Several growers in the Windsor and Gosford districts have installed the system under the guidance of Departmental officers.

Foliar absorption of chloride from saline water where overhead sprinklers are used was evident in the Murray Valley last season. Fruit officers at Dareton have commenced to extend the use of under-tree drag-hose and other systems of conversion away from overhead irrigation layouts.

Efficiency of Spray Machines

At the request of the Central Coast Agricultural Research and Extension Committee a survey of citrus spray equipment was conducted in the Gosford district to define weaknesses and recommend improved orchard spray techniques. The survey indicated that the oscillating boom is the most efficient citrus spraying method but that the cost of existing models is prohibitive.

The Department's agricultural engineer designed a suitable unit for the Gosford area but a Mildura engineering firm subsequently produced a cheap oscillating boom which could be attached to a fruit grower's existing plant. This equipment was loaned to the Department of Agriculture for demonstration on the Central Coast and at Bathurst. Many of these booms are now in use in the Gosford district. A local firm has started manufacture of a similar type which has also proved satisfactory.

Citrus Leaf Analysis Surveys

In co-operation with the Chemistry Branch, Division of Science Services, Divisional officers have now completed the fourth year of a citrus leaf analysis survey being conducted over 5 years. Nearly 150 citrus orchards have been surveyed throughout the State. The objects are to obtain more accurate data on critical leaf nutrient levels and to examine the leaf analysis technique generally as a tool for determining fertilizer recommendations.

Direct recommendations so far have been limited to survey orchards but the results have influenced fertilizer recommendations by fruit officers and salesmen, and fertilizer practices in all districts.

Controlled Atmosphere Storage of Apples

Following several years of research, considerable interest in adoption of controlled atmosphere storage of apples has been stimulated. Several stores of this type have come into operation in tableland districts.

Controlled atmosphere storage holds fruit in far better condition for the late market than conventional air storage. The availability of better quality fruit during the November-December period should considerably increase sales. District fruit officers have played an important role in this development. About 180,000 bushels of the 1968 season's crop will be stored under C.A. in N.S.W.

Spray Warning Service to Apple Growers

The District Spray Warning Service has now operated at Orange for 10 successive years. This major extension activity has materially assisted fruit growers to achieve maximum control of apple scab. The service operates by using Hirst Spore Traps and surface wetness recorders to determine spore discharge periods. The spray warnings, issued at critical times, increase the efficiency of spraying and avoid unnecessary applications.

Peach Pruning

The long lateral method of pruning peaches which has given higher yields in trials was demonstrated at field days at Yanco and Griffith. These field days were followed up by demonstrations to small groups and individual growers. A number of growers have used the method in trial plots. Use of the system is expected to increase this year even though there have been difficulties in persuading contract pruners to change their methods.

Stone Fruit Field Days

The Department's stone fruit research programme, other industry matters, and fruit packaging and presentation were highlighted at a major field day for dessert stone fruit growers. This was held at the historic Camden Park Estate, Menangle, in January, 1968. Over 300 growers attended.

Strawberry Production Field Day

A field day attracting over 130 persons was held at Glen Haven to demonstrate the latest methods of strawberry production. It is believed to have been the first field day ever in N.S.W. for strawberry growers. The response demonstrated renewed interest in the production of strawberry fruits.

Re-working of Robe de Sergeant Prunes

Poor quality of Robe prunes was discussed with a representative body of prune growers at Young. Various methods of converting Robe trees to the d'Agen variety were reviewed. This followed a decision of the prune industry to set separate home consumption quotas for the two varieties from 1970 onwards, in view of the poor demand for Robes in Australia.

Re-working demonstrations were conducted in all settlements. Results were affected by the drought that followed. Failure of old trees under these conditions confirmed the advice that the re-working of old trees is a questionable proposition. Few growers at Young have taken positive steps towards new plantings of d'Agens, to replace their Robes when the latter variety becomes even less profitable.

Technical Interchange on Banana Culture

Arrangements have been made for Australia to act as co-sponsor with the East-West Center of the University of Hawaii for a technical interchange on banana culture in 1969. The interchange will be conducted over a 2 weeks period in N.S.W. and Queensland banana growing areas and will bring together specialists in banana culture from South Pacific and Asian countries as well as special research personnel from countries outside the East-West Center boundaries.

Funds for the interchange will be provided by the East-West Center and the Commonwealth and State Departments of N.S.W. and Queensland.

Nematode Control in Bananas

A scheme operated jointly by the Division and the Banana Growers Federation to control nematodes in bananas has been expanded this year. Under the scheme banana planting material is heat treated, under supervision of Departmental officers, to kill any nematode infestations. In addition to the main heat treatment centre in the Tweed district two new centres were established, one at Coff's Harbour and one in the Richmond River district. Thus, growers in all the main banana producing areas are now able to take advantage of the service.

Plant numbers treated in 1967–68 were 206,500 at the Tweed centre (an increase of 4,000 on the previous year), 48,000 at the Richmond River centre, and 40,000 at Coff's Harbour. The total represents about 50 per cent of all banana plantings for 1967–68.

Packing, Presentation, and Marketing of Bananas

Improved packing and presentation of bananas for market was the theme of a major banana industry field day at Coff's Harbour attended by about 800 growers. Also, a symposium on economic aspects of banana marketing was organized at the request of the industry under the sponsorship of the Coff's Harbour Branch of the Agricultural Bureau.

Although cultural standards throughout the industry are high, there is room for improved marketing methods. Consequently extension activities have been concentrated on this.

Sultana Table Grape Quality

Following a concerted extension campaign many sultana growers in the Murrumbidgee Irrigation Area and Murray River districts are now using gibberellic acid and other methods to improve the quality of sultana table grapes. Based upon the results of research in the Lower Murray District this campaign has been most successful. The increasing popularity of sultanas as table grapes can be attributed in part to the larger berry size and the more attractive quality of fruit treated with gibberellic acid.

Table Grape Maturity

The combined effects of continued district extension, grape maturity testing services, and more thorough market inspections have been highly successful in reducing the quantity of immature grapes consigned for sale on the Sydney markets. Close liaison was maintained between the Export and Import Branch and District officers, particularly in the Campbelltown District where previously high rejection figures were reduced to two instances.

Location of an additional inspector (Plant Diseases Act) at Campbelltown will permit closer attention to roadside stalls on the Hume Highway. These are suspected as outlets for some immature grapes.

Irrigation of Drying Grapes

Results from an extension campaign in the Lower Murray district to improve the efficiency, frequency and timing of irrigation for drying grapes have been outstanding. A whole-farm demonstration has been established. On this the benefits of lighter and more frequent irrigation have been clearly established by greatly increased yields (100 per cent increases over three seasons).

Arrangements made with the Water Conservation and Irrigation Commission have permitted variations to the irrigation roster in the district. These allow extra irrigation and many growers are now using them to advantage. A series of three comprehensive articles dealing with the subject has been prepared for publication in the *Agricultural Gazette.*

Field Days for Grapegrowers

A successful grape field day was conducted at Orchard Hills. It was organized on an industry basis and designed to draw grape growers from throughout the coastal area. It is believed to have been the first ever field day specializing in grape production in this area.

A field day, well covered by the local press, radio and television stations was held at Griffith Viticultural Research Station to extend results of research on pruning and training. There is clear evidence of growers becoming increasingly conscious of better methods, particularly the advantages of T-trellis and disadvantages of excessively heavy pruning.

Other smaller field days dealt with use of herbicides, irrigation and table grape quality.

Assistance to Closer Settlement Advisory Board

Assistance was given to the Closer Settlement Advisory Board in its administration of settlement schemes. In particular, Divisional officers undertook a detailed survey of the Willigobung Estate at Batlow in technical assistance to the Board. The factors examined included profitability of each of the 16 pome fruit enterprises, the financial situation of each settler, and the effects of unfavourable climatic conditions on productivity during the last few seasons.

Fruit Packaging and Market Presentation

In co-operation with District officers the fruit packing instructor conducted 21 fruit packing and grading demonstrations, presented 17 sessions at field days, and was associated with packing schools at Batlow, Willigobung, Bathurst and Richmond. He also assisted in the staking and staffing of exhibits at the Orange National Field Day and at the Gosford and Camden Agricultural Shows. Overall he handled an ever increasing number of enquiries on fruit packaging.

Particular emphasis has been on the grading, packing and marketing of stone fruits, bananas, apples, and tomatoes.

Fruit Industry Trends

CITRUS INDUSTRY TRENDS

Seasonal Conditions and Developments

Although rainfall was normal in coastal citrus areas, serious drought conditions prevailed inland, with the M.I.A. and the Lower Murray areas recording only 4½ inches of rain during 1967. Fortunately the drought conditions broke in April/May, 1968, and good leaching rains have occurred throughout irrigation districts.

High salinity became a serious problem for Murray irrigation areas last year due to the lack of normal flushing flows through the river for three consecutive seasons; an effect of drought in the catchment areas. Normal increases in salinity over the river's length were aggravated by feed-back of saline drainage waters into the river. Funds have now been provided to divert many drainage systems away from the Murray.

A request from the citrus and vine growing industries resulted in a visit to the Murray fruitgrowing areas by Dr Leon Bernstein, of the U.S. Salinity Laboratories at Riverside, California. A world authority on salinity problems, Dr Bernstein gave excellent support to research and extension officers by stressing the importance of correct orchard management when utilising saline water.

Citrus Production

The final estimate of New South Wales production in 1967–68 was 6,890,000 bushels main crop citrus, plus 380,000 summer crop lemons and 190,000 second crop lemons—an overall production of 7,460,000 bushels of citrus. The general increase in production appears likely to be permanent. For 1968–69 the Department of Agriculture has made a preliminary main crop estimate of 7,000,000 bushels. As recently as 1965–66 the final main crop estimate by the Department was 4,640,000 bushels and for 1966–67 it was 5,900,600 bushels.

Production should continue to increase, as 20 per cent of the total 3,542,000 citrus trees have yet to reach bearing age. This indicates a potential crop of from 9 to 10 million bushels for New South Wales by the early 1970's. Also increased yields per acre have resulted through many uneconomic plantings having been forced out of production and through extensive use of trifoliata rootstock (resistant to *Phytophthora* decline) during the past 20 years in areas susceptible to the disease. In effect, the percentage of trees in full vigour has been increasing.

Production by varieties for 1967–68 was as follows:

	Main Crop	2nd or summer crop	Total
	bushels	bushels	bushels
Navels	1,696,000	......	1,696,000
Valencias	3,882,000	190,000	4,072,000
Commons	48,000	......	48,000
Sevilles	19,000	......	19,000
Lemons	595,000	380,000	975,000
Mandarins	480,000	......	480,000
Grapefruit	170,000	......	170,000
	6,890,000	570,000	7,460,000

Lemon Planting Trends

The bearing acreage of lemons in New South Wales has increased by 22 per cent in the past two seasons. A 50 per cent increase in plantings in the Windsor district has more than countered a sharp decline of acreage on the Lower Murray. Parts of the Windsor district, particularly Maroota, are well suited to high production of quality lemons with successive winter, spring and summer crops.

Popularity of lemons in new plantings in coastal districts continued, largely due to the success of the Lemon Marketing Board in having lemon processing recognized as an integral part of the industry rather than subsidiary utilization of overproduction. The current F.I.S.C.C. price of $65 a ton for processed lemons in the metropolitan area is most satisfactory for producers, but, if present planting trends continue, overproduction could become serious in a few years. Lemons reach maximum productivity far more quickly than other citrus varieties.

Market Conditions for Oranges

One million bushels of Valencias were produced in the Gosford district last season. Low market prices prevailed for most of the summer but prices were better late in the season. All of the crop was disposed of either as fresh fruit or for processing.

Valencias from the M.I.A. and Campbelltown maintained excellent internal quality late into the season. In contrast Navels in the M.I.A. were suffering from aged rind and puffing and creasing by the end of July.

Citrus Export

The Lower Murray district of New South Wales exported 203,700 bushels of citrus through the port of Melbourne. Destinations included New Zealand, France, United Kingdom, Manila, Hong Kong, Singapore, Oslo, and the Islands of Siberia. The M.I.A. exported 94,250 bushels, after EDB fumigation, through the ports of Melbourne and Sydney. The port of Sydney exported a total of 111,800 bushels of citrus fruit—from the M.I.A., New South Wales coastal regions and Queensland.

Nearly all citrus exported was "picked" as opposed to the earlier export requirements of "clipping".

Citrus Processing

The proportion of the citrus crop processed again increased. At Leeton, where a new factory was opened by Jusfrute, demand exceeded the supply even though 38 per cent of the district production was processed. The Leeton Cannery was also successfully blending citrus juice with apricot and peach purees.

Although coastal lemon production was far above preliminary estimates, processors met the situation for the main crop and also processed much of the spring crop.

Trends in Citrus Packing

The "rapid-pack" technique using the wide mouth Canadian or standard design bushel cases gained in popularity along the Murray and several more units were built in large sheds to replace rotary bin graders.

Cartons generally made a gain on wooden cases and appear to be favoured by packers, agents and retail stores. There was a strong move within the industry to adopt the 4/5th bushel container, both for local and export markets.

TROPICAL FRUIT INDUSTRY TRENDS

Banana Production

New South Wales growers forwarded 4,825,180 packages of bananas through the Banana Growers Federation transport system. This handles the bulk of the crop. About 950,000 packages (19 per cent of the total) were cartons packed in hands (1 carton = 7/10 bushel) and amounted to 665,000 bushels. The remainder were bushel cases (3,875,180) packed in singles. It is estimated that direct sales to country order trade, the M.I.A., Albury and Canberra, Wollongong, and Brisbane, amounted to a further 300,000 bushels. Thus, total production in New South Wales for 1967–68 seemingly comprised a record 4,840,180 bushels, an increase of 1,200,000 bushels over the previous year.

This production was from 23,469 acres and reflects a high standard of plantation management. This has lifted production average per acre to 206 bushels, the highest ever in New South Wales. Contributing to the massive increase are the higher plant density per acre, ideal growing conditions (no cyclones, severe storms, frosts or flood), eradication of marginal areas, and a high proportion of relatively young plantations.

Banana Planting Trends

There were 23,815 acres of bananas in New South Wales at 1st April, 1968, compared to 23,469 acres a year earlier. New plantings totalled 1,739 acres; 199 more than in 1966–67. These were offset largely by the 1,393 acres destroyed. Greatest net increases were in the Coff's Harbour and Tweed districts. Brunswick and Nambucca were up slightly. Richmond and Clarence were down. Most (1,200 acres) of the 1,393 acres destroyed was on the northern rivers. Growers continued the policy of removing areas when production begins to decline and to replant or replace to maintain about the same acreage.

The Williams variety continued to predominate, representing 90 per cent of total acreage. Cavendish plantings were reduced in all areas this year.

Total of commercial growers ("1 acre or more") continues to fall (now 2,940). Small area growers ("less than 1 acre") continue to increase (now 4,002).

Generally, planting densities have increased. There are now rarely less than 650 plants per acre, whereas the average was about 430 plants per acre 10 years ago.

Trends in Banana Containers

The steady trend is greater use of fibreboard cartons. The 30 lb hand pack in this type of container has gained popularity because of ease of packing, speediness and better outturn of fruit. The industry is seeking a wooden container suitable for packing hands for the more distant interstate markets. The current wooden case for hand packs to the M.I.A. is performing well and will be tested on interstate markets in the coming year.

New Markets and Products

There is renewed interest in banana processing. Commercial interests are probing the potential of dried banana products for local and export market.

Fresh fruit export of bananas has not been attempted this year, but there appears to be a rewarding potential in Japan if and when Japan's quarantine requirements can be met.

Proposed New Legislation—Banana Industry Act

Cabinet has approved preparation of legislation for a Banana Industry Act to be introduced to Parliament at an early date. The legislation would provide for constitution of a Banana Marketing Control Committee to control banana marketing in N.S.W.

Trends in Other Tropical Fruits

The areas of avocadoes, pineapples, macadamias and passionfruit in N.S.W. increased but for all except macadamias the new plantings were small.

Commercial areas of macadamia are being developed. One company has started planting a 250-acre project on the Richmond. Another will start to plant 100 acres as soon as trees are available.

The passionfruit industry has shown some revival. Processors are interested in the fruit for blending into mixed juice nectars now popular drinks. Growers are using the Queensland-bred hybrids. These give an extended cropping period. Also, passionfruit grafted on *P. edulis f. flavicarpa* stocks has become more popular, through disease resistance.

GRAPE INDUSTRY TRENDS

Wine Grape Production

N.S.W. production of wine grapes for the 1968 vintage is estimated at 47,000 tons, compared with the record 47,145 tons for 1967.

In the M.I.A., the State's largest wine-producing district, 40,550 tons of wine grapes were harvested. The record was 41,669 tons in 1967. Tonnages of the main varieties were: Semillon 7,361, White Shiraz 7,043, Black Shiraz 5,761, Doradillo 3,910, Grenache 3,733, Palomino 3,347, Pedro 2,503, and Gordo Blanco 1,760. An additional 5,021 tons of Sultanas, Gordo Blanco, and Waltham Cross were brought into the area from Victorian Murray River districts to augment winemakers' supplies.

Hunter Valley production of wine grapes is estimated at 2,200 tons, compared with 2,088 tons in 1967. In the Corowa/Barooga district 1,108 tons were delivered to wineries compared with 1,279 tons in 1967.

Total wine production in N.S.W. for the 1968 vintage is expected to be about 8,400,000 gallons. The record was 7,893,255 gallons in 1967.

Trends in Wine Grape Plantings

The continually increasing demand for table wines in Australia has further stimulated interest in planting wine grapes in N.S.W., because of proximity to large markets. Despite this interest, wine grape supplies are lagging well behind demand.

Analysis of planting and production figures presented to the M.I.A. Wine Grape Planting Advisory Committee showed that, on present yields, production in the M.I.A. by 1970 will not exceed 45,000 tons. This would be well short of the winemakers' projected need of 50,000 tons. The Committee has therefore expressed an urgent need for more wine grapes to be planted in the M.I.A., particularly Black Shiraz and Gordo Blanco.

At the December, 1967, vine planting census in the M.I.A. the total planted area was 5,884 acres, including 799 non-bearing. The net gain in plantings since the 1965 census was 361 acres.

In the Hunter Valley there are 1,760 acres, including 451 acres non-bearing. The total represents 436 acres more than in 1965. Other large areas are projected for planting in the next two or three years.

Plantings in Corowa–Barooga have remained static at 716 acres.

Considerable interest has also been shown in planting wine grapes in the Leeton, Murray, Young, Molong, and Wallacia–Werombi districts.

Trends in Wine Grape Prices

There was a general increase in prices paid for wine grapes in the M.I.A. but growers considered that still higher prices were justified. This was because of strong demand for wine grapes, increased costs of production, and increasing disparity between M.I.A. and South Australian prices. Prices for the main varieties were Black Shiraz $66 per ton, Semillon $64, White Shiraz $50, Doradillo $44, and Grenache $50. No adjustments were made for varying Baumes. Prices in the Hunter Valley remained at a high level of $220–$260 per ton.

Dried Vine Fruit Production

N.S.W. production of dried vine fruits in 1967–68 is estimated at 12,503 tons (dried weight). The record is 14,951 tons in 1966–67. Estimates of production of types are: sultanas 10,600 tons, currants 510, and raisins 1,390 tons.

Quality in general was good but the majority of currants were down-graded through splitting and mould development. The raisin crop is likely to be cleared early this season and raisins will be in short supply.

Dried Vine Fruits Industry Outlook

The International Sultana (Raisin) Agreement Conference held at Fresno, California, in June, 1968, announced that there would be no increase in the world price of the 1968 crop. The minimum price for the 1968 crop will remain basically at $290 per ton. Any future price reduction during the 1968–69 season was limited to $10 per ton and there was a rise of $4 a ton in Australia's British prices to cover higher freight rates.

As the world price is fixed in U.S. dollars, prices for sultanas marketed in the United Kingdom were not reduced following devaluation. So far, devaluation has had no effect on volume of sales on the London market.

Australia' dried fruit industry faces heavy losses when reduced traiffs under the Kennedy Round are fully implemented. It is estimated that the annual loss in export income for the industry will be about $855,000. This estimate follows the announcement that tariff preferences now allowed on Australian dried fruits by the United Kingdom, New Zealand, and Canada will be substantially reduced under the Kennedy Round of tariff reduction.

The effects of static world prices, reduction of tariff preferences and increasing production costs in the Australian dried fruit industry have been offset by marketing stability under the world price agreement and the Commonwealth Dried Vine Fruit Act. The Dried Vine Fruit Stabilization Plan expires with the marketing of the 1968 crop but it is likely that new legislation along similar lines will be introduced in 1969. It is anticipated that payment from the stabilization fund to growers for the 1968 crop will be approximately $20 per ton.

Rack Spraying of Sultanas

This season a quantity of sultanas after being spread on the rack was sprayed with dip mixture to accelerate drying. This was in lieu of the normal method of dipping the fruit in a bulk dip before placement on the racks. The fruit is sprayed with a specially adapted hand wand. The method has the advantages of reducing grit contamination, by eliminating greasy dip tins, and of easier handling. The rack spraying has so far been successful and could become standard practice.

"Containerization" of Dried Vine Fruits

Trial consignments of dried vine fruits were successfully shipped to the United Kingdom in container units. The containers were of 1,280 cubic feet capacity and held 11,023 cartons of dried fruit. It is proposed that the containers be packed in Murray River packing sheds and railed to Melbourne, thus reducing loading time.

Record Table Grape Production

N.S.W. production of table grapes for 1967–68 is estimated at a record 10,000 tons; compared with 8,200 tons in 1966–67.

Marketing of table grapes from the M.I.A. continued to decline. Only 207,394 half bushel cases were marketed, compared with 290,691 in 1966–67.

Production sold on the Sydney Municipal Markets comprised 200,000 half bushels from Murray River districts, 35,700 from Orange/Mudgee, 5,200 from the Hunter Valley and 264,000 (mainly Black Muscats) from the early table grape districts near Sydney. This fruit met strong competition in the 451,000 half bushels from Victoria, Queensland, and South Australia.

Prices received for local Black Muscats, normally regarded as a premium grade, were the lowest for years. This reflected poorly coloured fruit, and competition from Murray River sultanas.

Table Grape Exports

Some 22,875 half bushels were exported to overseas markets, an approximate increase of 11,000 on 1966–67 exports. This expansion is a direct response to an amendment of export regulations extending the permissible shipping time from 7 to 21 days for Cornichon, Waltham Cross, and Gordo Blanco varieties. The amendment was made because of results of grape storage research at North Ryde.

POME FRUIT INDUSTRY TRENDS

Production of Pome Fruits

The estimated N.S.W. apple crop for 1967–68 is 3,000,000 bushels, compared with the estimated 3,423,000 bushels in 1966–67. Pear crops have been estimated at 525,000 bushels, compared with 620,000 bushels in 1966–67.

The small crops, compared with the previous season, could be explained partly by the cumulative effect of several substantially unfavourable growing seasons but also by the severe infestation of plague thrips during blossoming. Many growers had to apply three separate spray applications towards control. Generally, very favourable price levels more than compensated for the reduced yields.

In contrast to the lower production in most districts, growers at Oakdale harvested one of the best crops of McIntosh apples ever and received very favourable prices. At the other extremity, most settlers on the Willigobung Closer Settlement blocks near Batlow had a disastrous season with heavy losses from frost, hail and sunburn.

Present indications are that the overall cropping potential for the 1968–69 season is good.

Pome Fruit Planting Trends

Growers are taking greater interest in high density plantings. The objective is to maintain or even increase production per acre and to achieve this at lower cost. Success of this movement will be mainly dependent on selection and availability of suitable rootstock varieties and appreciation of newer tree training techniques.

Northern Spy rootstocks should satisfy the needs of high density plantings until imported stocks at present under trial have been evaluated and then propagated for industry needs.

During the past year, for Bilpin district, planting of young trees tapered off. This was partly because of drought conditions and partly through industry realization of the likely rise in production—particularly apples. In some districts removals may have slightly exceeded new plantings.

Trends in Pome Varieties

Interest continues to centre on the imported Delicious strains. Trial plantings of these now carry useful amounts of fruit for evaluation. There is some apprehension that these strains, particularly Starkrimson, under good colouring conditions are inclined to deep and excessive colour—with dullness after withdrawal from cool store.

Interest in the Crofton variety has increased in favoured highlands sections. It is a good quality apple that matures later than other varieties constituting the majority of plantings.

In early districts only light plantings are expected. Most of these would be Cowells, Early McIntosh, and Golden Delicious.

At Orange many Williams pears have been reworked in recent years to the more popular Packham and Beurre Bosc varieties.

Cool Storage of Apples

Controlled atmosphere (C.A.) cool storage of apples was first used commercially in the 1966–67 season and proved very successful. Facilities have now been increased to the extent that about 180,000 bushels of the 1968 crop, mainly Delicious and Granny Smith, have been so stored. Most of the C.A. storage is at Batlow and Orange. There is a smaller unit at Kentucky.

Because of its high quality, C.A. stored fruit sold at premium rates on the Sydney market. Prices of up to $8 for Granny Smith and $12 for Delicious were maintained for this fruit during the last half of the season, whilst there were depressed prices for fruit stored by conventional methods.

C.A. storage facilities seem likely to increase. As this eventuates there will be greater marketing difficulties for growers of early apples using Sydney as a main outlet.

The spectacular development of cool storage facilities so evident a few years ago has now markedly slowed down. Even so, total cool storage space in N.S.W. is currently increasing by about 10 per cent per annum and is now in excess of 2,760,000 bushels. Orange district has the greatest concentration of cool stores, totalling 1,400,000 bushels capacity.

Apple Containers

Tray packs continue to be the most popular, given further impetus by the increasing adoption of the D.P.A. dipping process (in place of wraps) to control scald. Also, growers who are bulk handling and who utilize a post-harvest dip can now pack as desired through the winter period. Thereby they avoid the problem likely to have been caused by collapse of high stacks following lengthy storage in cardboard containers.

Some use tray packs to avoid need to employ skilled packers.

STONE FRUIT INDUSTRY TRENDS

Canning Apricots

The M.I.A. apricot harvest of 4,433 tons in 1967–68 was less than the normal for an "off-crop" year. Maturity was delayed by one week, compared with the previous season, and hot conditions affected sizing and quality. Fruit external appearance was generally good but uneven ripening, and pit burn, affected canning quality.

Growers are generally dissatisfied with an arrangement under which they are paid for fruit accepted by canneries on a proportional basis at canning grade and jam grade prices, respectively $100 and $70 per ton. As a result, little interest is being shown in the production of this crop. New plantings are insufficient to replace removals.

Canning Peaches

Production of canning peaches was better than anticipated early in the season. Hot, dry weather from December to end of February retarded fruit sizing but, fortunately, fruit matured late. The size improved under the better conditions experienced before the main crop varieties were harvested. Canneries accepted fruit to 2¼ in diameter and, with losses from brown rot lower than frequently experienced, final deliveries to canneries amounted to 21,226 tons. This was only 58 tons less than the record crop of the previous season.

Growers are having some difficulty in meeting quality standards required by the canneries, and in their replant programmes are tending to turn to other crops. New plantings of canning peaches are barely sufficient to maintain production at present level.

Prunes

Under drought conditions there was almost complete prune crop failure at Young. Only about 130 tons were produced there, compared with a normal of about 2,000 tons. The crop at Griffith was also lighter than in recent years. Total N.S.W. production for 1968–69 is not expected to exceed 1,800 tons. The record is 5,136 tons in 1966–67.

Growers at Young are concerned about the future of the industry there. Requests have been made for economic surveys to obtain comparative production costs at Young and Griffith, to help determine future policy on replanting and other matters.

Rate of planting in the M.I.A. has steadily increased. The upward trend in production there is expected to continue.

Dessert Apricots

The coastal crop of early apricots was very light and generally of poor quality, subject to breakdown with brown rot. Inland fruit was firmer and more marketable. Because of the marketing and disease control problems there have been no recent plantings of early apricots in the Kurrajong area.

Dessert Peaches

Dessert peach crops were good throughout the State. Except for a short glut period, corresponding wth the ripening of coastal Blackburns, prices were satisfactory for all well presented lines.

Plantings are expanding in the Campbelltown district and at Bathurst. Numerous new plantings are being made in scattered locations through the State. In the Hills district, there is particular interest in early maturing varieties recently introduced from overseas.

Plums

Crops of Japanese plums throughout the State were very light, but good crops of European varieties were produced at Orange.

Cherries

The crop at Young was severely reduced by drought. Much of the fruit was small and of poor quality. Medium crops of excellent quality fruit were produced at Orange and on the northern tablelands.

Following heavy drought losses at Young, about 45,000 productive trees, production there will be down for a few years. However, very few trees were lost from the 1 to 7 year age group and plantings were substantial over this period. So return to previous levels of production should be fairly rapid.

Because of several unfavourable years at Orange, new plantings there have been insufficient to balance removals. Consequently a slight fall in that district's production is expected.

New Packaging Containers for Stone Fruit

Greater use is being made of single layer trays for marketing quality lines of stone fruit. With the use of pliable plastic cups in the single layer containers, tree ripened fruit is being marketed in a bruise-free condition. These are finding their way to retailers catering for the luncheon trade in the city and to other shops specializing in top quality lines.

STRAWBERRIES

Planting of strawberries continues to increase, particularly in the Hills district and around Campbelltown and near Gosford. The variety Torrey has gained in popularity and is expected to take the place of Kendall as number one variety. Nared, recently released by the Department, did not perform well under all conditions experienced last season. It appears to be more suitable for warmer locations north of the Hawkesbury River.

THE INDUSTRY IN GENERAL: MECHANICAL HARVESTING AND CLOSER PLANTING

Interest is apparent throughout the industry in the possibilities for mechanical harvesting, and in close planting to produce more manageable trees. However, the only significant recent advance in harvesting has been for prunes. Shakers and catching frames are being developed for the prune harvest.

Regulatory Services by Division of Horticulture

LEGISLATION

Following discussion with grower and wholesale and retail marketing organizations, and the Queensland Department of Primary Industries, new tomato growing regulations were gazetted in N.S.W. The new regulations introduce higher standards for presentation and quality. As a result there has been overall improvement in the quality of tomatoes on the market. Certain segments of the producers, however, have not received the amendments favourably and further discussions are projected.

Grading regulations for citrus, stone fruit, bananas, berry fruits, and miscellaneous fruits are now under review.

Interstate discussions were held towards achieving uniformity between States in respect to approved fruit cases. Necessary amendments to the regulations under the N.S.W. Fruit Cases Act are being drafted.

The following new Regulations and Proclamations under the Plant Diseases Act were gazetted during the year: Reg. 43—Tomato Grading Regulation; Reg. 58, 59—Prescribed Traffic Signs in respect to Road Blocks, Proclamation re Entry of Grapevines into the Murray River district, Proclamation Prohibiting entry of onions and related sp. from areas in South Australia infected with Onion Smut.

Prosecutions and Warnings

A total of 161 warning letters were issued in respect to breaches, mainly marketing offences. Sixteen persons were prosecuted and a conviction was obtained in each case. These were mainly for marketing offences and offences against the M.I.A. Quarantine requirements. A further 17 prosecutions are pending.

PLANT QUARANTINE STATION

A quarantine station for the post-entry quarantine of plants is being established adjacent to the Division of Science Services at Rydalmere. Establishment and operation of this facility is a joint function of the Department of Agriculture and the Commonwealth Department of Health. Construction is nearing completion. The station should commence operation later in 1968. One double glasshouse and two screenhouses have been provided.

FUMIGATORS—EXPORT AND IMPORT BRANCH AND RICHMOND

Two large vacuum fumigators have been installed at Export and Import Branch and are now ready for use. The extra volume of traffic and the handling of goods for fumigation could cause considerable congestion on the ground floor of the Day Street premises.

A mobile fumigator was installed at Richmond to permit on-the-spot fumigations of items entering Australia through the RAAF base and needing treatment.

Five inspectors passed the Public Health examinations for the Fumigator License.

FRUIT FLY CAMPAIGN

The campaign against Queensland fruit fly has been maintained. Further towns have undertaken whole-town treatments. In a year when fruit fly was more prevalent than normal, fruit fly remained well under control in all towns west of the Dividing Range where treatments were applied. By contrast, many untreated towns were heavily infested.

Unfortunately trapping of three isolated adult male Queensland fruit flies in the Murrumbidgee Irrigation Areas, despite the absence of any fruit infestation, interfered with citrus fruit export and necessitated EDB fumigation of all consignments. In all, 183 fumigations, comprising 42,230 cases of citrus, were conducted at Griffith. A further 15 fumigations for 2,750 cases of fruit for the Philippines were supervised at Dareton, a fly-free area.

Entry of post-harvest treated bananas into the M.I.A. continued successfully and accounted for 21,426 cases of bananas. Because of difficulties in respect to supplies the demand was not fully met and more fruit could have been marketed there.

INTRA-STATE QUARANTINE

There were further discussions with the N.S.W. Rice Co-ordination Committee on matters relating to rice quarantine and the entry of second-hand bags into rice-producing districts. In light of the discussions, draft legislation can now be prepared.

Fruit and plant quarantine were actively enforced in the Murrumbidgee Irrigation Areas. Eighty-five road blocks and road patrols were conducted. A number of offenders were apprehended. Prosecution was instituted in a number of cases.

MARKETING OF IMMATURE FRUIT

Fruit maturity testing services for producers were continued. It is significant that most offences for immature fruit being offered for sale in the Sydney markets involved fruit from other States. Immature grapes seized comprised 1,426 half-bushel cases; an increase on the previous year. There was little incidence of immature citrus.

An effect of maturity testing services provided by the regulatory officers is that most growers now realize the advantages of ensuring fruit is mature before sending it to market.

COUNTRY INSPECTION OF EXPORT FRUIT

Formal country inspection of export fruit was introduced for the 1967–68 export season. Packers may now submit fruit for inspection in the producing area. Likewise, presented fruit for export not meeting export requirements may be rejected by the country inspector. Previously such consignments could be forwarded for final decision at a shipside inspection, should the packer so elect.

PLANTING AND REMOVAL STATISTICS NOW ON "SHIRE" BASIS

The importance to the fruit industry of having accurate records of plantings and removals is self-evident. One of the functions of the regulatory services of the Division of Horticulture is to compile details of plantings of fruit trees and vines throughout the State. So that requests by local government bodies for details of plantings can be met, these statistics are now available for each shire. Previous compilations were made on a "District" basis comprising several shires.

SYDNEY CITY MARKETS INSPECTIONS

Fruit—Quality and Supplies

Apples. Supplies of old season apples were good until mid-November. Controlled atmosphere stored apples were released in October and sold well. Choice fruit was available until December.

Early apples in the new season were in short supply and realized good prices. Moderate supplies have continued from later districts and generally been fair quality. Supplies have been supplemented with good quantities from Tasmania.

Pears. Supplies have again been mainly from Victoria and last season's fruit tapered off during October. Quality was poor towards the end of the season, mainly due to internal breakdown and superficial scald. New season's pears were heavily supplied early. So far these have shown marked improvement in presentation and grading over previous years. Small quantities of good quality pears have come from New South Wales districts.

Oranges. Navels were almost off the market by mid-October. High quality Valencias were available throughout the season. A shipment of oranges was received from California.

New season navels came forward from Queensland early. Their flesh paleness and insipid flavour restricted sales. Local navels were marketed as they matured, followed by large consignments of Leng navels from Riverland districts. Only a few small consignments were withheld from sale through immaturity.

Lemons. Supply was only moderate throughout the year. Some consignments of Meyers from Queensland showed the physiological disorder Peteca and met buyer resistance.

Grapefruit. In plentiful supply earlier in the season, but scarce in early 1968. Quality was generally good. A thousand cartons were brought in from California in April. The fruit were not good quality, and severe breakdown caused a high percentage of loss in repacking.

Mandarins. Queensland fruit was generally of good quality and attractively presented. Local fruit suffered by comparison, although some growers are now packing in half-bushel cartons —a vast improvement on the usual second-hand case.

Cherries. There were good supplies from Orange in particular, and an increased quantity from Victoria. The cherries from early districts and Young were small. There was better quality from Orange.

Apricots. Early fruit was in moderate supply and generally small and of poor quality. Brown rot was general. Deliveries from Menindee were light compared with last season. Fruit from Victoria was small but sound and clean, and from the M.I.A. was of average quality.

Peaches. Supplies were light from early districts, of poor colour, and small. There were heavy supplies of mid-season varieties, affecting prices. Peaches from Bathurst district, although small, sold well. Tray packs always brought premium prices.

Plums. These were in short supply throughout the season. Quality was good but size was less than average.

Nectarines. In short supply; poor colour and small size.

Bananas. Through shortage of staff, inspection of bananas was not continuous throughout the year. Grading was satisfactory, although regulatory action was necessary throughout the year for undersize fruit. Glut supplies were on the market from November to March, with considerable mixed ripe and "boiled" fruit. By May, grading and quality were generally very good, except for some consignments showing corky scab and weather damage.

Grapes. Early supplies were available from Queensland in mid-December and continued from all sources to the end of May. Maturity tests were done on all early consignments and resulted in 1,426 half-bushels (case or carton) being seized and destroyed. The offending varieties were mainly Sultanas and Waltham Cross from Murray Valley districts.

Pineapples. Pineapples were of average quality. Picking in a backward condition detracted from quality. Blister was prevalent early. A glut was experienced for a short time when factories did not operate. Local processors are buying more pineapples for juice extraction.

Avocadoes. Overall quality was very good. Increasingly avocadoes are being marketed in tray cartons, excellent for handling.

Custard Apples. Supplies were average. Mealy bug damage was more prevalent this year.

Mangoes. Supplies were adequate. Quality was only fair and size was lacking.

Strawberries. Supplies were good throughout the year from Queensland, New South Wales, and Victoria. New South Wales growers received good returns for well presented fruit. New Zealand supplied 38,000 cartons of high quality strawberries; 16,000 more than last year.

Tomatoes. Supplies were moderate to heavy. Queensland was the main supplier through the winter and early spring, with increasing quantities from the North Coast. Local glasshouse tomatoes were the main supplies in the late spring. Their quality was poor. From mid-November local field crops provided the market requirements.

Tomato quality was extremely variable. A lot of regulatory action was required. The growers seem slow to realize that improved quality and presentation are profitable.

Potatoes. The number of bags inspected at Perry Park, Alexandria, etc., approximated 1,288,928; a decline of 211,072 from the 1967 season. However, contravention of the grading regulations resulted in an increase of almost 24,000 bags in the quantity withheld from sale.

In all, 62,827 bags were withheld from sale. The main reasons were: unbranded, incorrect grading, and second-hand bags from interstate. Some 3,225 bags were infested with potato moth, and 887 bags were affected with eelworm; and as a result of pickover 1,012 bags in this quantity were destroyed. Inspections in the growers' market resulted in 1,480 packages (mainly in banana cases) being found to contravene the Grading Regulations.

Vegetables. Supplies were sufficient to meet the demand.

Fruit Pests. At the markets only a small quantity (111 bushels) of fruit was found to be infested with fruit fly. The fruit was destroyed. And 119 bushels of apples were destroyed because of codling moth infestation.

Grading and Presentation. These continued to improve. Increased use of fibreboard containers has enhanced the appearance of practically all lines of fruit.

PLANTS, FRUIT, AND VEGETABLES TO OTHER STATES

Consignments of Plants

Inspections were carried out in the County of Cumberland by metropolitan inspectors and also at the Export and Import Branch. "Certificates of Freedom from Disease" were issued for about 50,000 plants. "Certificates of Treatment" were issued for about 100,000 plants. These figures are similar to the previous year's.

Fruit and Vegetables

During the year 7,545 cases of fruit and 8,523 packages of vegetables were inspected for interstate destinations, mainly to Tasmania. This also involved supervision of EDB treatment of citrus to Tasmania.

EXPORT INSPECTIONS

Fresh fruit and vegetables, seeds, rice, wheat, flour, etc., submitted for export were examined on behalf of the Commonwealth Department of Primary Industry under provisions of the Commerce (Trade and Descriptions) Act.

Pome Fruit Exports

Apples. A total of 66,262 bushel cases and cartons of apples were shipped from the Port of Sydney; 97,000 bushels less than in the previous year. Increased freight costs and devaluation of sterling partly explain this.

About 50 per cent of the apples were consigned to the U.K. and the Continent. The remainder were shipped to South-East Asian and Pacific Island destinations.

Rejects totalled 1,575 bushels. The reasons were overmaturity, pit, San Jose scale, and inadequate pre-cooling. Generally, however, the quality of the fruit was satisfactory. Most of the fruit was from Forbes and the northern tablelands.

Pears. The quantity shipped totalled 17,585 cases; an increase of about 4,000 bushels on the previous year. Main destinations were the U.K., South-East Asia and Pacific Islands. Rejects totalled 959 cases. The reasons were ripe fruit and inadequate pre-cooling.

A trial shipment of 1,975 cases was shipped to New York. To comply with quarantine regulations in the U.S.A., this fruit was subjected to in-transit cold sterilization.

Citrus Exports

Oranges. 104,894 bushels were exported, an increase of 2,000 cases on the previous year. Most were shipped to South-East Asia and a smaller percentage to Pacific Islands. As a considerable volume of the New South Wales exports of citrus are made through interstate ports, figures represent only a part of the total exports.

Trial shipments were limited to three this season. These were 199 cartons of experimental picked oranges to Dunkirk and two consignments of oranges in cartons to Manila, totalling 2,498 bushels. All shipments, trials and conventional, received favourable outturn reports.

Citrus rejects totalled 7,138 cases. The reasons were oleocellosis, torn rinds, albedo breakdown, and broken skins.

Mandarins. 3,074 bushel cases of mandarins, mostly interstate origin, were exported. Most were shipped to Canada. They were of high quality and received very favourable comments from overseas.

Rejects totalled 3,050 bushels. These were mandarins submitted for shipment late in the season and deterioration was obvious. The reasons were puffy fruit, albedo breakdown, and broken skins.

Lemons and Grapefruit. 1,866 bushel cases of lemons and 1,967 bushel cases of grapefruit were shipped; consigned to the Pacific Islands.

Other Export Fruit and Vegetables

Stone Fruit. The types and quantities shipped were peaches 10,630 cases, plums 6,377 cases, apricots 2,931 cases, cherries 6,923 cases, and nectarines 1,547. This was an increase of about 13,000 cases over the previous year. The shipments were to the Pacific Islands.

Grapes. A total of 22,875, mostly half-bushel, cases were shipped, about 11,000 cases more than in 1966–67. In the total were three trial shipments; 100 cases of Waltham Cross in South African packs to Vancouver, and two lots totalling 7,807 cases of Waltham Cross grapes to Manila.

Excepting the trial shipments, all grapes were exported to Pacific Island destinations. Grapes shipped to the Philippine Islands were subject to in-transit sterilization.

Tomatoes. 39,305 cases were exported; an increase of 25,000 cases over 1966–67. The substantial increase was due supplies to the U.S. armed forces in the Philippines.

Miscellaneous Fruits. 560 cases of custard apples, avocadoes, pineapples, and melons, and 1,020 trays of strawberries were exported. These were to Pacific Island destinations.

Vegetables. 122,139 packages of various vegetables were shipped, mainly to Pacific Island destinations; an increase of about 14,000 packages over the previous year. Rejects were heavy because of soil contamination, insects, and containers not complying with commerce Regulations.

Cereal Exports

Bulk Wheat. Wheat inspection has been constant at Sydney and Newcastle terminals. Details are as follow:

Wheat ship surveys: Sydney, 134; Newcastle, 83; total 217.

Ships rejected for cleaning, spraying, or fumigation; Sydney, 27; Newcastle, 13; total, 40.

Tons of wheat loaded: Sydney, 1,701,644; Newcastle, 853,730; total, 2,555,374 tons.

Tons of wheat rejected; Sydney, 49,000 (infestation); Newcastle, 30,000 (infestation); total, 79,000.

Bagged Wheat. Bagged wheat was usually in small parcels and inspected at the Export and Import Branch or shipside. The total was 2,600 tons.

Flour. 105,415 tons of flour were shipped; 4,000 tons less than in the previous year. Main destinations were Ceylon, Malaysia, Pacific Islands, U.K., Aden, and Pt Louis. Rejections were: 700 bags for insect infestation; 559 bags affected by water; total, 1,259 bags.

Rice. Exports increased by 20,000 tons to 96,723 tons. The main importing countries were New Guinea and Pacific Islands. Rejections were small; only 20 tons, for larvae on the bags.

Exports General

Approximately 5,500 International Health Certificates were issued, covering all nursery stock examined at metropolitan nurseries. Also in this total are all items not calling for an Export Permit. These included pasture, vegetable, and flower seed. Cut flowers totalled 2,275 cartons, mainly inspected at Mascot Airport.

IMPORT INSPECTIONS

Importation of plants and plant products from overseas were examined for the Commonwealth Department of Health in accordance with the provisions of the Quarantine Act.

Imported Nursery Stock

The quantity of nursery stock imported showed a moderate increase over the previous 12 months and generally followed the trend of past years. Some 11,380 plants were held under the regulations. These included 4,579 orchids, 1,074 ornamentals, 1,900 succulents and cacti, 412 aquatic plants, 1,166 bulbs and rhizomes, 2,034 rose budding eyes and 92 sugar cane cuttings.

Initial inspections showed pest and disease to be very slight. Pests detected included aphids, mites, mealy bugs, and scales. All of these were controlled by methyl bromide fumigation before release.

Main diseases detected were virus and nematodes. Post-entry inspections at quarantine nurseries have resulted in a small number of plants being destroyed after disease confirmation by the Chief Biologist.

Parcel Post Inspections

Inspection of all goods arriving from overseas and subject to plant quarantine continued throughout the year at the Sydney Mail Exchange. A total of 10,157 parcels and packages were withheld for examination. Of these, 1,236 were detained for further examination, treatment or destruction.

Ship, Waterfront and Aircraft Inspections

Passenger Ships.—Two hundred and seventy-two overseas passenger vessels were attended on arrival for inspection of goods and articles brought to inspectors' attention by Customs officers. Considerable quantities of goods were detained for treatment or destruction.

Aircraft.—At Mascot Air Terminal the number of flights increased from 5,020 last year to 5,833. The number of passengers increased from 294,688 to 409,611. Prohibited items, including fruit, seized and subsequently destroyed, totalled 116 quarantine bags. Items detained and forwarded to Day Street for further action totalled 411. Bond inspections totalled 1,652 which included a considerable quantity of berry fruits from New Zealand and imports of cut flowers, etc.

At Richmond RAAF Station 351 aircraft from overseas points were inspected. These carried approximately 17,725,000 lb of cargo and 2,800 passengers. Articles quarantined included wooden cases, soil, fruit, and various curios, etc. Parcels from U.S.A.F. parcel post were also found to contain some restricted goods. Certain goods were also detained on behalf of animal quarantine.

Dunnage.—Large quantities of dunnage were landed from overseas ships. A big percentage was found to be infested with wood boring insects. All dunnage was either fumigated or destroyed by burning.

Personal Effects.—The number of appointments increased this year to 1,942 and the number of articles inspected almost doubled to 50,308. There was corresponding increase in total of articles quarantined to 2,700.

Cases and Packing.—Three inspectors have been on regular inspections of the waterfront, mainly concerned with cargo not requiring a quarantine permit. This has resulted in considerable cargo being stopped from delivery, mainly due to wood-boring insects in cases and crates but also to contaminated cargo (grain and soil), straw packing, used sacks, etc. These inspectors have also been responsible for clearing pallets which are now under quarantine permit.

Advent of containers this year has posed quarantine problems. Difficulty is being experienced in ascertaining the contents. When subject to inspection, special arrangements were made for the examination of containers.

General Wharf Inspections.—Regular inspections of all items of ship's cargo requiring quarantnie permits were carried out. These covered the usual range of pasture seed, dates, coffee, cocoa, copra, etc.

There was a 34 per cent increase in total of motor vehicles inspected, to 21,865. Of these, 2,105 were not new. Of these, in turn, 882 required steam cleaning for removal of soil. Of the 19,760 new vehicles, 128 required steam cleaning.

Restricted seeds imported included beans for culinary purposes (12,086 sacks) and for agricultural purposes (90 sacks). Because of Australian crop failures 1,000 tons of rye, 15,000 tons of safflower, and 4,783 tons of linseed were imported. These were handled and processed under strict supervision, as were the normal imports of peanuts, hops, etc.

The following imports were fumigated because of insect infestation: soybean meal 9,164 sacks, onions 1,400 sacks, rice 374 sacks, cumin seed 316 sacks, chillies 27 sacks, pine nuts 15 cases, mace 14 sacks, and dill seed 8 sacks.

Considerable quantities of various spice seeds were quarantined for presence of foreign seeds. Where cleaning was not practical, grinding was done under supervision.

To comply with Customs (Narcotics) requirements, 1,230 sacks of Blue Poppy or Maw seed were identified and devitalized.

Inspections at Quarantine Station, Day Street.—Quarantine inspections totalled 8,681; an increase of 3,374 on the previous year. These comprised a typical cross-section of all quarantine goods, usually in small quantities. They included 39,319 lb of flower seed and 109,272 lb of vegetable seed. All items required detailed examination.

Timber Inspections.—Imports into N.S.W. ports totalled 216 million super feet, a 6 per cent decrease on last year—mainly due to a 29 per cent decrease in oregon from North America. There was a light infestation of oregon again this year. All came from the one source in the U.S.A.

Malaysian sawn timber increased by 58 per cent and logs by 78 per cent and there was a consequent sharp increase in the quantity quarantined; 5¼ million super feet, an increase of 90 per cent on last year.

Of 40 million super feet of meranti from Malaysia 2½ million super feet were quarantined. These involved 380 lines.

Carpenter Ants caused serious concern. Several ships were found to have infestations originating in dunnage from the east coast of North America. This required fogging and spraying of complete holds, and in some cases cargo fumigation.

Of the total imports, 216,385,000 super feet, the total qurantined was 5,344,000 super feet.

DIVISION OF ANIMAL INDUSTRY

General

PROFESSIONAL STAFF

Appointments, Resignations, Vacancies

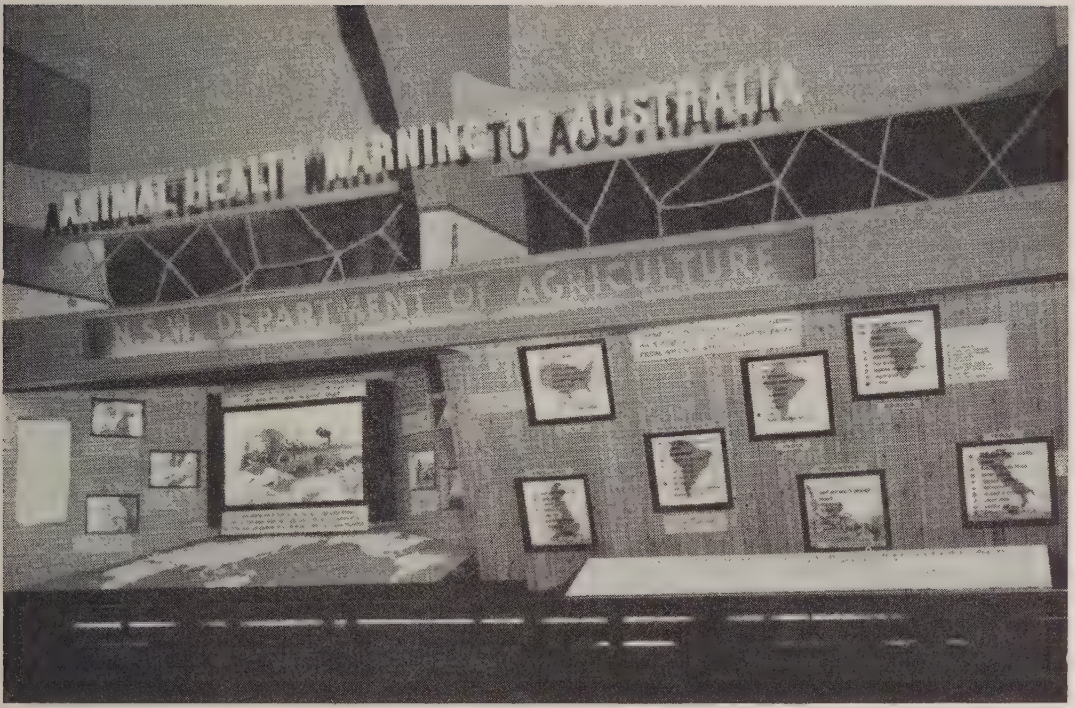
Dr R. B. Dun, Director of Animal Production research, has been seconded to the Australian Meat Board for three years.

One veterinary research officer was appointed, one resigned, and there are two vacancies; six veterinary officers were appointed, two resigned, and there is one vacancy; two livestock research officers were appointed, two resigned, and there are three vacancies; thirteen livestock officers (sheep and wool) were appointed, and one resigned; two livestock officers (beef cattle) were appointed, one resigned, and there is one vacancy; five livestock officers (pig) were appointed, two resigned, and there is one vacancy; two livestock officers (poultry) were appointed, one resigned, and there is one vacancy; no livestock officer (apiculture) appointment or resignation occurred and there is no vacancy.

Advanced Degrees/Diplomas

Veterinary Research Officer, Dr J. B. Smith, was awarded the Ph.D. by the Australian National University. His thesis was "The responses of the lymphatic system to antigen".

Livestock Research Officer, Dr D. G. Fowler, was awarded the Ph.D. by the University of New South Wales. His thesis was "Studies on the association of skin folds and fertility of Merino rams".


ANIMAL HEALTH WARNING TO AUSTRALIA
N.S.W. DEPARTMENT OF AGRICULTURE

Exotic Diseases Warning

The Department's 1968 R.A.S. show exhibit provided comprehensive warning of what could happen to livestock industries if certain diseases not here were to enter from other parts of the world. England's epidemic of foot and mouth disease in 1967 provided dramatic material for one of the display bays.

Veterinary Research Officer, Mr P. Claxton, was awarded a Diploma in Bacteriology by the London School of Tropical Medicine.

Ten officers currently are candidates for Ph.D. degrees; two through overseas universities and eight through Australian universities. Nine others are working for the degree M.Sc.

Officers Overseas

Ten officers were overseas for whole or part of the year: District Veterinary Officers, Messrs R. B. Bonner, F. W. Evans, and E. R. Hunt, assisted in the control of foot and mouth disease outbreak in the United Kingdom; Veterinary Inspector Mr C. F. Cargill studying for the M.Sc. degree at University of Alabama, U.S.A., on a Rotary International Scholarship; Veterinary Research Officer Mr P. D. Claxton studying for the Diploma in Bacteriology at the London School of Tropical Medicine; District Veterinary Officer Mr R. E. Everett studying for the Diploma in Animal Health at the University of London; Principal Livestock Officer (Apiculture) Mr A. A. Clemson visited the U.S.A., Canada, U.K., and Europe to attend conferences and investigate honey production; Livestock Research Officer Mr J. F. Dillon doing research at the University of British Columbia, Canada, for the Ph.D. degree on a Commonwealth Scholarship; Livestock Research Officer Mr G. L. Lee doing research at the University of California, U.S.A., for the Ph.D. degree; and Research Officer Mr J. Nolan doing research at Cornell University, U.S.A., for the Ph.D. degree.

NEW VETERINARY LABORATORIES

The District Veterinary Laboratory, Wollongbar, to serve the north coast was opened and is operating. Building of a new virology, serology and amenities wing at the Veterinary Research Station, Glenfield, has started.

Livestock Health—Field Activities

REGULATORY DISEASE CONTROL

Anthrax

Thirty-seven outbreaks were recorded; significantly more than the twenty recorded in the previous year. Stock vaccinated totalled 164,446, on 201 properties; whereas in the previous year 126,679 stock were vaccinated, on 132 properties.

All but two outbreaks were in the recognized anthrax belt. One of the two outside the belt was on a property where the disease occurred two years ago but where vaccination had been neglected. Two outbreaks were associated with anthrax in persons, one a farm-hand and the other a veterinarian who necropsied an infected carcase.

By the official policy, three routes whereon anthrax had occurred in the preceding five years were quarantined. Their use was restricted to stock vaccinated against anthrax and those transported by motor vehicle.

The following table shows the 1967–68 distribution of outbreaks:

Administrative District	Outbreaks	Stock Quarantined				Deaths		
		Cattle	Sheep	Pigs	Horses	Cattle	Sheep	Pigs
Central West	2	154	306	45	27	1	..	28
Far West	2	..	5,000	12	..	..	7	3
North West	1	961	..	..	..	15	..	..
South	5	563	5,211	..	..	33	4	..
South West	6	90	4,885	..	8	4	39	..
West	21	1,546	42,713	62	32	66	498	8
Totals	37	3,314	58,115	119	67	119	548	39

Brucellosis (*Pigs*)

Two infected properties were detected and quarantined. In one case, the diagnosis arose from investigations of poor breeding performance. Of serum samples tested from 23 head of breeding stock, 14 were positive and 5 doubtful. *Brucella suis* was isolated from a splenic abscess in one sow. All breeding stock was slaughtered to eradicate the disease.

Evidence indicated that the infection may have been introduced by a purchased boar. So the herd this animal came from were tested. Six of the 18 breeding animals gave positive and 5 gave doubtful reactions. Control of the disease on this property was being effected at the end of the year.

The property where swine brucellosis had been diagnosed in the previous year was released from quarantine.

The voluntary Brucellosis Free Herd Scheme was maintained. Sixteen herds were accredited.

Footrot (*Sheep*)

In most parts of the State footrot was not a major problem.

In the Armidale Quarantine Area comprising some 4,000 owners and 5,000,000 sheep, there were 9 known infected properties at the start of the year and during the year 18 more outbreaks were recorded. Eradication measures were deemed successful on 17 holdings, leaving 10 infected at the end of the year. Of the 9 holdings known to be infected at the start of the year three were still infected at the close.

In other parts of the State, footrot was a problem mainly only where irrigation was practised. Notably, an eradication programme on one large property running about 30,000 sheep under irrigation appeared to have eliminated the disease.

Johne's Disease

The previous policy of long term quarantine of properties where Johne's Disease is detected has been replaced by a policy of destruction of affected animals—and only limited quarantine. The property is placed in quarantine only until all clinical cases have been slaughtered (subject to compensation). Where breeding cows are the affected animals their last calf if still on the property is also slaughtered. The dam of any infected animal is slaughtered if evidence warrants this.

On introduction of this policy three holdings in quarantine were released.

A clinical case of the disease was detected this year on a property where the disease had occurred from time to time over the past 20 years. As the affected animal was a young cow, its dam was slaughtered.

In a herd where there had been a high incidence of No Visible Lesion (N.V.L.) reactors to the tuberculin test and a history of Johne's Disease incidence suggested *Mycobacterium paratuberculosis* might be complicating the tuberculin test.

Parasites External (*Sheep*)

The following table shows the numbers of holdings and sheep quarantined because of presence of sheep lice (*Damalinia ovis*) and sheep ked (*Melophagus ovinis*):

Administration Area	Lice Infestation		Ked Infestation		Lice and Ked	
	Holdings	Sheep	Holdings	Sheep	Holdings	Sheep
Central	13	12,244	..	..	..	..
Central West	103	38,779	15	8,448	..	..
Cumberland	2	100	4	305	5	2,770
Far West	51	148,900	..	..	..	..
North	207	349,293	46	52,072	11	22,000
North West	48	60,454	..	..	..	..
South	109	123,565	..	..	1	12
South East	72	79,512	48	78,828	12	10,749
South West	130	108,864	..	..	..	..
West	48	58,600	..	..	..	..
Totals	783	980,311	113	139,653	29	35,531

Pleuropneumonia contagiosa (*Cattle*)

No outbreak occurred. Six head of cattle showing suspected symptoms were destroyed but subsequently were shown to have been not infected.

A consignment of 345 steers being forwarded to Okinawa were tested before export and all gave negative reactions to this Department's normal test. But there was one positive reactor to the more sensitive test required by the Okinawa authorities.

A further 493 head of cattle which could have been in contact with this group were given both tests. Five gave slight reactions to the N.S.W. Department test and positive reactions to the Okinawa test. These five were forwarded to Glenfield Veterinary Research Station for additional studies. In further testing on this property seven of 131 cattle gave positive reactions to the Okinawa Test. Subsequent testing showed titres to be falling.

Because of the improved pleuropneumonia situation in Queensland, conditions of entry into the N.S.W. Protected Areas have been modified for cattle originating from the South Eastern Queensland Protected Area. For the same reason the Northern Districts Quarantine Line maintained in N.S.W. south of and parallel to the Queensland border since 1942 was abolished. Movement of cattle southwards across this line had been subject to permit.

Some 13,898 cattle were tested this year, mainly for movement, export, and survey purposes.

Pullorum Disease (*Poultry*)

Testing continued, voluntary under the Accredited Flock Scheme and compulsory under the Stock Diseases Act regulations. The latter required annual testing of all flocks from which chickens under three weeks of age or hatching eggs are sold. Following is a summary of the testing done under both schemes:

Scheme			Positive		Doubtful	
	Flocks	Birds	Birds	%	Birds	%
Accredited flocks (Sydney Area)	78	555,019	1,060	0·19	782	0·14
Accredited flocks (Country Areas) ..	20	69,548	84	0·10	156	0·22
Total accredited ..	80	624,657	1,114	0·18	938	0·15
Compulsory testing (Sydney Area)	36	69,090	158	0·23	656	0·9
Compulsory testing (Country Areas) ..	9	78,141	2	0·003	21	0·02
Total compulsory ..	45	147,231	160	0·11	677	0·46

The birds tested totalled 771,888. Compared with the previous year, reactor incidence under the Accredited Scheme declined from 0.31 per cent to 0.18 per cent while for flocks tested compulsorily under the Stock Diseases Act regulations the incidence declined from 0.93 per cent to 0.11 per cent. Thirty-nine hatcheries were accredited.

Modified antigens were used this year for the rapid whole blood test. They seemed more suitable than those available previously. Non-specific reactions were greatly reduced.

Swine Fever

No case occurred. The previous outbreak is now believed to have been eradicated. Regulations introduced at the time of the outbreak, restricting the public sale of pigs, were maintained. This was largely because of their effect in reducing spread of other infections. Boiling of refuse before being fed to pigs was policed, particularly refuse from defence establishments. One such contract was cancelled because the recipient had failed to carry out the boiling.

Restrictions on clearing-out sales and sale of stud pigs were relaxed to a limited extent.

Trichomoniasis (*Cattle*)

Trichomoniasis was diagnosed in a dairy herd. The herd has shown poor breeding performance, with more than normal frequency of return of cows to service. Measures taken included quarantine, slaughter disposal of an infected bull, and use of artificial insemination. There was evidence of bull movements between the infected and an adjoining holding, but investigations on five neighbouring properties did not reveal the disease.

Tuberculosis (*Cattle*)

Quarantine Area Scheme. The programme of compulsory testing of all cattle within quarantine areas initiated in 1960 was continued. At the start of the year there were 76 areas. Four were added this year. All areas are coastal and dairy cattle predominate in most. Testing was done this year in the 80 areas. Routine tests of herds were by approved practising veterinarians but retests, necessitated by detection of reactors, were done by Departmental veterinary officers.

Cattle tested totalled 845,516, as against 761,677 in the previous year. Reactors detected in all testing under this scheme totalled 844 (0.09 per cent of cattle tested), the lowest percentage since the scheme started.

The class of testing which yielded highest incidence of reactors was retesting by Departmental veterinary officers of herds found infected. Reactor incidence in these tests was 0.64 per cent. Lesions of tuberculosis were not detected in 33.3 per cent of reactors. However, N.V.L. reactors represented only 0.03 per cent of cattle tested.

N.V.L. reactor problems were met in two herds. In one, 30 per cent of the cattle tested showed very small reactions. Thirty-five of those showing the largest reactions were slaughtered and lesions of tuberculosis were found in 19. Difficulty in demonstrating and culturing acid fast organisms from the lesions resulted in protracted guinea pig inoculation procedures. Finally an organism was sub-cultured but its identity has not been finally determined. This herd had a previous history of Johne's Disease and the possibility of this infection sensitizing cattle to the tuberculin test was considered.

In a second herd wherein reactors had not been previously experienced, 13 cows showed positive at a routine test. Four were forwarded for slaughter as a pilot group but none showed lesions of tuberculosis. The cause of the sensitization was not determined.

There was considerable movement of cattle on agistment to quarantine areas from Victoria and the New South Wales southwest where there was drought. Departmental veterinary officers tested these cattle. As far as possible the testing was before entry but this was not always possible and many had to be tested within the quarantine areas.

Statistics of testing done this year are in the following table:

	Cattle Tested	Reactors Cattle	Reactors Per cent	NVL Reactors Cattle	Reactors NVL Per cent
1st Round	75,420	51	0·07	13	25·5
2nd Round	234,171	142	0·06	29	20·4
3rd Round	203,002	185	0·09	60	32·4
4th Round	101,001	39	0·04	15	38·5
5th Round	91,267	47	0·05	21	44·7
Retests	55,055	350	0·64	125	35·7
Introductions	85,600	30	0·04	18	60·0
Totals	845,516	844*	0·09	281	33·3

* *In the* 1966–68 *Annual Report* the number of reactors in this section was incorrectly stated as 2,224 instead of 1,280 and 0.29 per cent of the cattle tested instead of 0.17 per cent.

Tubercle-free Herd Scheme. Under this voluntary scheme of accreditation 56 herds and 10,483 head of cattle were tested. There were 32 reactors. A further 41 herds, accredited in the previous year for two years, were not tested.

Tubercle-free Milk Scheme. A scheme which applies to the larger cities is administered by the New South Wales Milk Board. Under this scheme 26 herds containing 8,513 cattle were tested. There were 28 reactors.

Municipal and Shire Councils supervise another scheme. This operates mainly in the small cities and towns. Testing was done under this scheme in 22 areas. Cattle tested totalled 2,202 and there was no reactor.

The two schemes operate on similar lines, designed to ensure that raw milk sold for human consumption is produced by herds accredited by the Department of Agriculture.

Miscellaneous Testing. This included compulsory testing of infected herds outside quarantine areas, and voluntary testing for export, sale, exhibition, or diagnostic purposes. Tested cattle totalled 34,259, and 368 reacted.

Stock Diseases Act amendments in the previous year provided for compulsory identification of all cattle being consigned for sale or slaughter. This would enable property of origin to be determined if cattle were found at slaughter to be tuberculous.

This year a suitable type of tail tag was decided on as the means of identification. Each tag would bear a number to indicate name and address of owner. Drafting of regulations to give legal force to the details of the scheme is proceeding, and a system is being devised for recording tag numbers of cattle found at the abattoirs to be tuberculous.

Tuberculosis (Pigs)

The 1966–67 Annual Report mentioned a herd with an infection that appeared to be an avian strain of *Mycobacterium tuberculosis* showing low virulence for poultry. The isolate has been shown to have characteristics consistent with Battey type (group 111—Runyon's classification) but has not yet been finally classified.

Macroscopic lesions do not appear, so far, until pigs reach bacon weight (6 months). Changing back from marketing a heavy porker/light baconer to a baconer type has been associated with increase in number showing lesions at slaughter.

Infection with Battey type mycobacteria was suspected in three other herds. One of these had received pigs from the herd wherein the isolate was obtained. Another was founded with introduced stock and some of these were from a piggery in another State where Battey type infection was subsequently diagnosed. Source of infection in the third herd was not determined.

Neither avaian nor Battey type tuberculin proved satisfactory diagnostic agents. Quarantine was maintained on the four herds.

Three other properties where tuberculosis was diagnosed in pigs were also quarantined. Ten holdings where pigs were previously found infected remained in quarantine throughout the year. Two others were released. The tuberculin test was applied to 1,647 pigs, on 15 holdings, and 326 reactors were detected.

Tuberculosis (Poultry)

Eighteen properties were quarantined on account of avian tuberculosis; a reduction on the previous year's 26 and a big reduction on the 56 outbreaks detected in 1965–66. Quarantine was maintained on 32 other properties where the disease had been diagnosed before 1967–68, and 46 were released.

Of the 18 outbreaks detected in 1967–68, only seven were in the southwest where most flocks previously found infected had been located.

The tuberculin test is not usually applied in the control of the disease but was this year on six properties and there were 88 reactors in the 653 birds tested.

GENERAL DISEASE PROBLEMS

Abortions (Sheep)

Infection with *Vibrio fetus,* frequently in association with *Toxoplasma gondii* was the prime cause of abortion and neonatal losses of pathogen character. Many of the outbreaks were associated with handfeeding during pregnancy. Crows, known carriers, were attracted to the feed.

On one property where abortions associated with vibriosis had been a problem for some years past, a trial was set up using an autogenous vaccine. This yielded no significant difference between lambing performances of vaccinated and unvaccinated ewes.

An organism believed to be identical with *Histophilus ovis* was isolated at the District Veterinary Laboratory, Armidale, in large numbers from the placenta of a ewe which had aborted. About 50 per cent of lambs in a breeding flock of 150 ewes were lost. A characteristic was late abortion and a haemorragic placentitis. The organism was inoculated intravenously into two ewes. One of these proved to be pregnant and gave birth to a live but small and weak lamb six weeks after inoculation. The organism was recovered from the placenta.

Actinobacillosis (Sheep)

Actinobacillus lignieresi was recovered from specimens from an outbreak wherein 10 Merino wethers in a mob of 300 developed face abscesses. The abscesses were confined to the non-woolled part of the head and face from the ears forward, and in some animals involved the whole of this area. There was marked fibrosis of subcutaneous tissues. The abscesses discharged into the oral cavity as well as to the exterior. Lymph nodes in the head region contained similar abscesses.

At the time of the mortality the sheep were being hand fed on grain and hay. Weaners running in the same paddock were unaffected.

Air Sacculitis (Turkey Poults)

Air sacculitis was further investigated using turkey poults from which *Mycoplasma meleagridis* had been previously isolated. The organism's role as a pathogen has not been fully determined. Embryos in eggs from affected birds showed advanced air sac lesions. The disease continued to be important in mortalities in Tamworth District and forced some farmers to spell their farms by suspending production for several months.

Arthritis (*Sheep*)

Incidence of lamb polyarthritis caused by a psittacosis-lymphogranuloma virus was higher this year, particularly on the western slopes. The virus was recovered at Glenfield Veterinary Research Station from many cases, while numerous flocks recorded high titres to the complement fixation test. Penicillin was as effective as broad spectrum antibiotics in promoting recovery.

On a property where lambs were alternated between hill country and lucerne flats the disease was observed only on the flats. A trial is being organized to determine whether the animals not on lucerne actually are not infected or become infected without showing symptoms.

Sheep Blow Fly

Activity of *Lucilia cuprina* was generally below average. There was some activity in the spring and again in the late summer and autumn but no serious fly wave. There was no significant field development in regard to fly tolerance to organophosphates and carbamates, but organophosphate jetting provided in some cases only a limited period of protection.

Brucellosis (*Cattle*)

This continued to be widespread in the State and numerous investigations were carried out into the occurrence of abortions arising from it. Strain 19 was applied on a voluntary basis; with use of the vaccine restricted to registered veterinarians.

The survey started in the Hunter Valley area in the previous year to determine incidence with a view to possible eradication was continued there and extended throughout the State. Milk ring tests were applied at factories, to 1,342 samples belonging to 193 owners. Reactions to the +++ level were given by 17 per cent of samples, ++ reactions by 23 per cent, and + reactions by 17 per cent. Also, the milk ring test was applied to all milking cattle (totalling 778) in 10 herds. There were 17 +++ recations and 136 ++ reactions and 179 + reactions.

To determine incidence in beef cattle, serum samples were had from cattle being slaughtered at various abattoirs. The 1,747 samples were submitted to the tube agglutination test, and 97 were positive whilst 67 were doubtful.

In further testing (for diagnostic, sale, exhibition and export purposes) 9,116 serum samples yielded 1,114 positives and 347 doubtfuls.

The voluntary Brucellosis-free Herd Scheme was continued. Six herds were accredited.

Brucellosis (*Sheep*)

For lack of support by breeders the voluntary Brucellosis-free Flock Scheme was abandoned.

In 6,276 serum samples submitted to the complement fixation test for diagnostic, sale, exhibition and export purposes there were 1,557 positive reactions and 135 doubtfuls.

Chronic Respiratory Disease (*Poultry*)

Incidence of this was high throughout the year. Mainly young birds 4 to 6 weeks of age were affected, usually after outbreaks of infectious bronchitis-nephrosis. Several outbreaks were in replacement pullets and there were reports of resistance to several established methods of treatment. In these cases there were heavy losses, and some flocks were sent to abattoirs.

Coccidiosis (*Poultry*)

Coccidiosis was again in broiler flocks despite routine use of medicated feed. Because of possible occurrence of resistant species of coccidia, a rotating treatment of weekly administration of different coccidiostats was applied on several farms but no conclusive result has become available.

Most outbreaks were associated with infectious bronchitis and chronic respiratory disease and occasionally with necrotic enteritis. These diseases cause loss of appetite, with consequent reduced intake of coccidiostat.

Congenital Diseases (*Calves; Lambs*)

Calves.—In a Poll Jersey stud there was congenital blindness affecting five calves. Symptoms were bilateral nystagmus, slight or absent eye preservation reflex and defective vision. Necropsy showed varying degrees of retinal atrophy.

In a Poll Hereford stud a few calves were identifiable at birth by a characteristic fine, dense, fuzzy hair coat. Such animals were usually well developed and showed no behavioural abnormality until found dead any time between birth and six weeks of age. All cases consistently showed cardiac muscle abnormalities such as areas of complete replacement by hyaline tissue, paleness or white flecking. The sires of affected calves could be traced to a common ancestry.

Lambs.—In a small stud Dorset Horn flock, more than 50 per cent of lambs born were found affected with a flexure of the limbs. The condition appeared to result from a tightening or shortening of the flexor tendons. When the disorder appeared in twins both lambs were affected.

Ephemeral Fever (*Beef and Dairy Cattle*)

A State-wide epizootic occurred. The disease entered the far north west from Queensland in January, 1968, and by February had appeared throughout the remainder of New South Wales. Unlike previous outbreaks, there seemed no distinct pattern of spread.

In the inland beef raising areas the outbreak was much milder than previous epizootics and spread much slower. In some areas almost all herds became affected while in others, the majority escaped. Within affected inland herds morbidity was generally below 5 per cent, but in exceptional cases up to 80 per cent were affected. Losses were generally light but were severe on some properties during a January heat wave or where stock were weak and became bogged.

Among coastal dairy herds, the epidemiology followed in February a similar pattern to the more inland areas but in March the disease virulence increased greatly and most dairy herds experienced high morbidity—in some cases almost 100 per cent. Some herds had the disease two and three times; the same animals affected on each occasion. Milk production showed a dramatic drop.

The disease caused a limited number of abortions and deaths in dairy cattle, the latter mainly bulls and aged cows. The outbreak had abated by April throughout most of the State but persisted in coastal districts until May.

Where sporadic bovine encephalomyelitis is enzootic there was difficulty in clinically distinguishing the two diseases.

Enteritis (*Sheep*)

A number of outbreaks of diarrhoea in lambs and weaners were investigated. In two cases, losses were severe. In one flock of 850 Merino lambs, 40 died and 300 became affected within a week. In a second flock of 1,800 lambs, about 70 died and 300 showed rapid loss of weight over a three weeks' period.

A feature of all outbreaks of this type of enteritis was rapid response to treatment with sulphadimidine over a three days' period. The cause was not finalized, but *Escherichia coli* was recovered from some cases.

A mortality wherein there was diphtheritic character caused loss of 12 of 120 unweaned lambs grazing mainly improved pasture and an oat crop. Clostridial organisms suspected of being the cause were in some areas of affected bowel. About 30 lambs recovered after suffering severe check in growth rate.

Heartworm (*Dogs*)

Heartworm (*Dirofilaria immitis*) has generally been regarded as confined to the coast, particularly the subtropical portion in New South Wales, but this year it was shown to be widespread in dogs in the Far West.

Infectious Bronchitis (*Poultry*)

Infectious bronchitis, particularly the nephritic form, continued as a serious problem in young chickens. In general, chickens two to six weeks of age were affected, but the disease was also in some under one week of age. Contrary to present concepts, some observations suggested that the disease is egg-borne.

Vaccination against the disease with available live commercial vaccines was not entirely satisfactory and many poultry farmers discontinued the practice. There was some evidence that treatment with electrolytes at the first sign of coughing prevented severe development of mortality.

In a number of investigated cases of rapid fall in egg production infectious bronchitis was the suspected cause. The disease significantly increased moulting and consequently the total of culls.

Infectious Laryngotracheitis (Poultry)

Many outbreaks were recorded, particularly in the Sydney and Tamworth areas. Most were comparatively mild. Mortality was generally light, though one owner lost 7,000 of 20,000 birds.

Preventive vaccination was widely applied. A number of breakdowns at about 5 to 8 days of age occurred, in chickens vaccinated during their first 3 days. Some breakdowns also were in layers a few weeks after vaccination. The conjunctival route of vaccination is rapidly displacing the cloacal route and has been generally accepted as successful and advantageous.

Infertility (Cattle)

Many herd fertility problems were investigated, particularly in dairy cattle. *Vibrio fetus* was isolated from foetal specimens from two herds. Based on the syndrome, the mucus agglutination test and detection of the causal organisms, vibriosis was diagnosed as the cause in 40 herds. However, in many cases the cause of infertility was not determined.

Internal Parasites (Cattle)

In coastal districts the mild winter led to survival of more larvae than usual, with consequent increase in the clinical incidence of parasitism in calves during the spring. *Ostertagia* spp. were the predominating parasites, but *Trichostrongylus* spp. and *Cooperia* spp. were also important.

Ostertagiosis of both type 1 and 2 occurred, the latter to a significant extent in mature cattle—particularly bulls. Treatment of the type 2 infection usually required three to four thiabendazole or tetramisole administrations.

Thelazia spp. were identified as a cause of keratitis for the first time in New South Wales. They were in the eyes of cattle on two northern properties. On each property about 25 per cent of cows and calves showed varying degrees of keratitis, from slight corneal involvement to large opaque areas. There was subsequent evidence of spread of the parasite, when affected eyes were found in cattle being slaughtered at the Guyra and Tenterfield abattoirs (in the same region as the affected properties), and also at Orange abattoir, in the Central West. The worms recovered were *Thelazia gluosa* and *Thelazia skrjabini*.

Internal Parasites (Sheep)

Mild late winter and spring conditions, together with cloudy weather and showers, favoured the larvae survival on pastures. So lambs on many properties showed evidence of worm infection. *Trichostrongylus, Nematodirus,* and *Ostertagia* spp. predominated in the spring; but *Haemonchus contortus* and *Oesophagostomum columbianum* caused trouble later in the year, particularly on the Northern Tablelands.

The *Haemonchus contortus* strain resistant to thiabendazole, previously encountered on three Northern Tablelands properties, was found on two more properties in the same area. On these properties the drug had been extensively used over a long period. But on a property where thiabendazole had been used regularly since its first introduction, studies showed no sign of tolerance.

Strains of *Thrichostrongylus colubriformis* resistant to thiabendazole were found on two properties. In a comparison of the effectiveness of other broad spectrum anthelmintics tetramisole removed 99 per cent of resistant worms and pyrantel tartrate removed 75 per cent, while parbendazole was completely ineffective. On each of the two properties there was a history of sheep being run at high stocking rates on irrigated pasture and receiving thiabendazole treatments at regular 3-weekly or monthly intervals over a long period.

In the southwest, heavy infections with immature paramphistomes caused mortality on several properties where sheep were running on poorly drained land. Up to 162,000 immature parasites were found in individual sheep. Treatment with yomesan satisfactorily overcame the problem.

Leptospirosis

In cattle, leptospirosis was not a major problem but caused abortions and calf deaths on some properties. At the Newcastle abattoir, the condemnation of a high percentage of kidneys from vealers from one property led to investigations. Affected kidneys showed chronic interstitial nephritis. *Leptospira pomona* was recovered from some kidneys. Testing of in-contact cattle on the property revealed high incidence of affected cattle.

The disease was found to have been brought to an Artificial Stock Breeding centre through introduced heifers. Although these heifers had given negative reactions to the agglutination test before introduction, 2 of 59 were positive when tested on the Station 3 weeks later. A further 11 reacted at a test conducted a month later. A further group was positive after 5 weeks. All groups containing positive reactors were removed from the Station and all ground exposed to contamination was given a long spell.

No bulls had been exposed to the infection introduced by the heifers, but one bull which had been introduced to this centre after test mating and a negative test for leptospirosis was found to be positive. No semen had been used from this animal.

In routine testing of cattle throughout the State, 614 serum samples were submitted to the agglutination test and of these 114 were positive and 13 doubtful.

Leptospirosis continued to be the major cause of abortion in pigs. Preventive vaccination was undertaken on many properties. Of the 118 pig serum samples submitted to the agglutination test 56 were positive and 2 doubtful.

Lice (Cattle)

Lice infestation of cattle, particularly beef animals, became widespread late in winter. Publicity encouraged farmers to treat for these parasites and the treatment was more widely done than in previous years. In some herds lice caused considerable loss in condition.

Marek's Disease (Poultry)

This was the most common disease of replacement pullets. Up to 45 per cent mortality was observed involving pullets 3 to 4 months of age. The disease appeared increasingly frequent in broiler flocks, causing considerable losses a few weeks short of marketing. Some outbreaks were in birds only 5 weeks of age and some, too, in birds as young as 3 to 4 weeks.

Mastitis (Dairy Herds)

Mastitis in dairy herds continued to be a major problem. Farmers' interest in securing more efficient control increased, partly due to extension advice and partly to the stricter standards at many factories increasing the rejections of milk—based on the sediment test.

Investigational work was done, much of it in association with Division of Dairying and the N.S.W. Milk Board. The work included studies of sanitation in milk sheds, testing of milking machines, the use of the California mastitis test, laboratory examination of milk samples for types of organism concerned, and antibiotics' sensitivity tests.

For a planned campaign against mastitis, a Committee has been formed. It is representative of the Animal Industry, Dairying, Science Services, Marketing and Agricultural Economics Divisions and the Biometrical Branch of this Department, the University of Sydney and the N.S.W. Milk Board.

The proposed programme is in two phases. In the first phase, demonstrations applying mastitis control principles will be established on about forty farms—with each herd supervised by departmental field officers and the programmes supported by laboratory examinations. Response to the control measures will be assessed through incidence of mastitis, effect on production and the economic benefit. The demonstrations are to run for two years and be a prelude to phase two. This second phase of the programme will aim at general adoption of the mastitis control principles throughout the dairying industry and will call for participation by practising veterinarians as well as departmental officers.

Oedema Disease (Pigs)

This continued to be a widespread cause of mortality in pigs, though individual property losses were generally not high. Control measures included liberal molasses supply in the drinking water, withdrawal of other food for forty-eight hours, and administration of antibiotics.

In a mortality which continued despite tylosin in the feed, the causal *Escherichia coli* was found to be serotype 0141 and resistant to many common antibiotics.

Paratyphoid (Poultry)

Paratyphoid due to *Salmonella typhimurium* was diagnosed at two major hatcheries. Originally a build-up in incidence occurred in a turkey flock attached to a major hatchery.

This build-up may have resulted from intensification of husbandry practices. Spread from the turkeys to the poultry flocks soon occurred and lead to many acute outbreaks in broiler flocks—with up to 20 per cent mortality. The predominant necropsy finding in chickens and poults was caseous typhlitis.

Poisonings

Anacystis cyanea.—This species of algae caused several mortalities inland, in sheep and cattle which drank from infested dams. The toxic stage of infested dams was usually of short duration. Effect in some cases depended on wind moving the algae to the side of the dam from which the stock normally drank.

Anthelmintics.—Several slight mortalities in sheep after pyrantel tartrate drenching were investigated. Main symptoms were shivering and stiffness. On necropsy, congestion of lungs with frothy material within the bronchi was found. It was suspected that the toxicity arose from intratracheal insufflation of the drug.

Light mortalities after clioxanide drenching were also investigated on several properties. The characteristic lesion was almost complete necrosis of the epithelial cells of the convoluted tubules of the kidney.

Two mortalities following oxyclozanide administration were investigated. In one case the sheep had received about double the recommended dose. In the other case, a mob of travelling sheep, dosage was followed by extremely cold wet weather. The salient features of these losses were weakness and collapse, with varying degrees of gastro-enteritis.

Nitrite.—In the south and southwest there were many heavy mortalities in the late autumn. Mostly the cause of the toxin was oats making rapid growth, but variegated thistle (*Silybum marianum*) was involved in some cases.

Swainsona spp.—In the far northwest, Darling pea made prolific growth after early autumn rain and considerable sheep losses occurred. In higher rainfall areas Darling pea has been successfully controlled by pasture improvement, but for stockowners in this area a suitable control is not available because the rainfall is too light for economic pasture improvement.

Polioencephalomalacia (Sheep and Cattle)

Polioencephalomalacia although not a major cause of mortality was more frequent in both sheep and cattle than in previous years. Most losses were not high but one owner lost 42 of 500 Merino wether weaners. The disease was usually associated with sub-optimal though in some cases not particularly bad nutritional conditions.

"Q" Disease (Poultry)

Increased incidence was recorded. No specific treatment is available. Cause of "Q" disease is unknown but the incidence and spread and history of outbreaks have strongly suggested infectious origin. Some farmers reported outbreaks in successive batches of chickens of the same age. Others reported spread from shed to shed in chickens of the same age.

The disease was mainly observed in chickens one to three weeks of age and in a few chickens up to 6 weeks of age. The course of the disease is 2 to 5 days, causing losses in the range 5 to 40 per cent. Mortalities up to 60 per cent were recorded in hot weather. It was estimated that up to one and a half million chickens were lost this summer in a heat wave associated with the presence of the disease.

Salmonellosis (Sheep)

Some outbreaks occurred in sheep held for excessive periods at abattoirs, awaiting slaughter and receiving inadequate feed. *Salmonella typhimurium* was the pathogen in most cases, but also *S. bovis morbificans* and *S. anatum* were recovered from outbreaks.

Sporadic Bovine Encephalomyelitis

Incidence was considerably higher than previously. Most cases were in the west and northwest. Generally, individual property losses were not high. Treatment of many cases was by using broad spectrum antibiotics and there were indications that early treatment was beneficial.

The complement-fixation test for psittacosis-lymphogranuloma-venereum (P.L.V.) group virus antibodies was done on serum samples from many suspected cases of the disease. Accumulated results suggested that antibody response is commonly developed within the period of clinical disease so that significant rise in titre between clinical and convalescent phases is not general. The antibody titre also appeared independent of clinical severity. Thus, subclinical cases showed titres comparable to clinical cases. Recovered animals appeared to lose their titre completely within 6 months.

During the ephemeral fever outbreak clinical distinction between the two diseases was difficult. In the west large numbers of serum samples from clinical cases were submitted to the complement fixation test for P.L.V. antibodies during the outbreak. Most were negative, suggesting that ephemeral fever was the disease operating, but about 30 per cent showed positive for P.L.V. antibodies.

White Muscle Disease

Lambs.—White muscle disease in lambs continued enzootic on those parts of the northern tablelands where pastures are predominantly white clover. Control was satisfactory by selenium administration.

Pregnant Ewes.—An outbreak of the cardiac form caused loss of 20 of 1,500 ewes aged 3 to 10 years on a southwestern slopes property. The animals were in advanced pregnancy, and mostly in good condition. No loss occurred there in dry ewes. When the losses started, the sheep were receiving limited paddock grazing supplemented by oat grain. Shortly afterwards the oats was replaced by barley.

Pigs.—Several mortalities through the cardiac form in pigs were investigated. Lesions comprised diffuse subacute interstitial myocarditis, with some foci of necrosis. Affected pigs had received normal rations.

Miscellaneous Activities by Veterinary Personnel

Services for Government Farms

Departmental veterinary officers provided a clinical and disease control service to livestock located at Government farms. This year 310 such services were given. The work included testing for disease, diagnosis, treatment, vaccination, surgery, post-mortems, and pregnancy determinations.

In-Service Training

Twenty-three veterinary officers and 15 veterinary inspectors attended a course in Gross Pathology conducted by the Post-Graduate Committee in Veterinary Science. A veterinary officer and inspector were also present at a Ruminant Nutrition course organized by the same body. Two veterinary officers attended the Extension Methods School conducted by the Department. Veterinary officers and inspectors officially attended science sessions of the Annual Conference of the N.S.W. Division of the Australian Veterinary Association.

A school on disease control was held for rangers in the Western Division. There being no veterinary inspectors in this area, rangers investigate and advise on disease matters—unlike rangers elsewhere.

Conferences

A 1-day conference of senior veterinary officers was held in Sydney. A 2-day conference on general disease matters was attended by official veterinary personnel in the areas of the North and North West District veterinary officers, and in 5 Districts 1-day conferences were held to discuss extension programme planning.

The assistant principal veterinary officer (disease control) officially represented the Department at the Annual Conference of the Australian Veterinary Association. Other officers attended in private capacity. Veterinary inspectors attended the Annual Conference of their Institute.

The Chief of Division and 3 senior veterinary officers participated in a Departmental 4-day workshop on Extension Policy and Design.

A Conference of official veterinary personnel in the North Eastern District discussed submission of specimens of the new District Veterinary Laboratory, Wollongbar. Also in North Eastern District, a conference of cattle inspectors discussed compensation and disposal methods relative to cattle infected with tuberculosis and some other diseases.

Lord Howe Island

A veterinary officer visited Lord Howe Island to test all cattle for tuberculosis, brucellosis, leptospirosis. Clinical attention was given to two horses.

Pesticide Residues

Because of possibility of carcass residues, efforts were made to discourage use of organo-chlorines to control insects in premises where poultry are kept and also use of wheat treated with hexachlobenzene.

Quarantine for Disease

Following amendments to the Stock Diseases Act in the previous year, it became necessary this year to introduce a revised form for notification of owners or occupiers by an inspector declaring land to be a quarantine area because of presence or suspected presence of diseased stock.

Exotic Diseases

Three of the Division's veterinary officers were among 22 Australian official veterinarians who participated in Foot and Mouth Disease eradication measures in England in the worst pandemic in the country's history. They gained valuable experience in diagnosis of the disease and in the eradication procedures.

Plans to deal with it if an outbreak of Foot and Mouth Disease occurred in N.S.W. were reviewed in the light of the observations of the three officers, and all States' plans were to be reviewed before being finalized early next year at the first meeting of the reconstituted Exotic Diseases Sub-committee of the Commonwealth and States Veterinary Committee. This would clear the way to arrange assistance from other authorities and organizations and arrange training of Departmental field and laboratory staff, to be fully prepared.

Proposals re Hydatid Disease

The State-wide control of hydatid disease has been under consideration for some time and a committee representative of the Department of Public Health and this Division recommended that an Authority be set up to undertake a programme. The assistant principal veterinary officer (disease control) visited Tasmania to observe the control programme there.

Test Mating of Bulls

Twenty-one bulls were tested for genital and other diseases at Glenfield Veterinary Research Station. The testing involved mating with virgin heifers, and bacteriological and serological examination of material from the bulls and the heifers.

All bulls passed the necessary health tests. Eight were subsequently transferred to the Graham Park Artificial Stock Breeding Centre at Berry, 11 to the Artificial Stock Breeding Centre at Aberdeen, 1 to Hawkesbury Agricultural College, and 1 to Wagga Agricultural College.

Rabbit Myxoma Virus

Glass ampoule packaging of myxoma virus has been replaced by aluminium foil sachettes as developed by the CSIRO. The sachette contains both dried virus and a fine abrasive, and the contents applied directly to the eye of the rabbit eliminate need for a syringe.

There was marked increase in demand for virus. Some 468 requests were received, the highest total since 1959. In all, 117,000 rabbit doses of virus, in 6,116 packs, were despatched to country centres in N.S.W. Virus was also forwarded to the Australian Capital Territory, South Australia, Western Australia, and the CSIRO.

Vaccine Testing

Glenfield Veterinary Research Station annually checks, for sterility and safety, samples of vaccines available for use in livestock and in the case of anthrax, contagious ecthyma, fowl pox, and infectious laryngotracheitis, also checks for efficiency. This year one case of mislabelling was detected and one case of contamination by a viable yeast.

Laboratory Diagnostic Services

The following table shows the totals of consignments of specimens received at the Veterinary Research Station, Glenfield, the Colin Blumer District Veterinary Laboratory, Armidale, and the District Veterinary Laboratory, Wollongbar:

Specimens Received

Class of Animal	At Glenfield	At Armidale	At Wollongbar
Cattle	3,561	538	68
Sheep	1,475	500	1
Poultry	938	128	1
Pigs	538	80	25
Horses	54	9	1
Other animals	190	9	1
Plants	69	7	..
Miscellaneous specimens	182	29	..
Totals	7,007	1,300	97

The following tabulation indicates the source of diagnostic material received at the three laboratories:

Sources of Diagnostic Material Received

Submitter	Glenfield	Armidale	Wollongbar
Departmental officers and veterinary inspectors	3,956	926	66
Veterinary practitioners	2,166	325	31
CSIRO, Universities	..	34	..
Owners	885	..	..
Miscellaneous sources	..	15	..
Totals	7,007	1,300	97

During the year official policy was changed to require that specimens to Glenfield Veterinary Research Station be submitted only by veterinarians and scientific personnel. This policy was already in operation at the District Veterinary Laboratory, Armidale. Previously material had been accepted at Glenfield Veterinary Research Station from owners. The revised policy was also made applicable to the new District Veterinary Laboratory, Wollongbar.

Extension Service by Veterinary Personnel

Individual Contacts

Considerable individual-contact extension was done by veterinary officers and veterinary inspectors when investigating flock and herd problems and by meeting stock owners at places such as saleyards.

Group and Mass Media. Use of these means was also considerable. Some 89 sessions were conducted at schools for farmers organized through various primary producer bodies, mostly the Agricultural Bureau. Demonstrations were given at 24 field days. Fifty-three radio broadcasts were made. Three officers made telecasts. Exotic diseases of livestock was the theme of the Departmental exhibit at the 1968 Sydney Royal Show.

Extension Programme Planning

Following official Departmental adoption of programme planning in extension work, subject goals were drawn up as the basis of concerted extension programmes to be implemented by veterinary officers and veterinary inspectors under the supervision of District veterinary officers. The subjects planned for each District have been tabulated:

Veterinary Administrative District	Goals
Central	(i) Control of mastitis in cattle. (ii) Control of cattle lice. (iii) Control of brucellosis in cattle. (iv) Control of enteritis in baby pigs. (v) Correct use of vaccines.
Central-West	(i) Judicious use of vaccines against clostridial diseases of sheep. (ii) Prevention of pregnancy toxaemia in sheep. (iii) Control of brucellosis in cattle.
Cumberland	(i) Control of mastitis in cattle. (ii) Raise fertility levels of sheep.
North	(i) Control of worms in cattle. (ii) Prevention of enterotoxaemia in cattle.
North-East	(i) Promote practice of pregnancy diagnosis of beef cattle. (ii) Encourage keeping proper breeding records in dairy herds.
North-West	(i) Control of worms in sheep. (ii) Prevention of pregnancy toxaemia in sheep.
South	(i) Control of footrot in sheep. (ii) Judicious use of vaccines against clostridial diseases of sheep. (iii) Encourage correct tail tagging of cattle as required by regulations. (iv) Control of worms in sheep and cattle.
South-East	(i) Correct use of vaccines against enterotoxaemia of sheep. (ii) Prevention of pregnancy toxaemia in sheep. (iii) Control of grass tetany in cattle.
South-West	(i) Control of heliotrope poisoning in sheep and cattle. (ii) Judicious use of vaccines against clostridial diseases of sheep. (iii) Prevention of baby pig losses.
West	Judicious use of vaccines against clostridial diseases of sheep.

Publications

Four issues of the quarterly publication *Veterinary Notes* were produced and distributed to official veterinary personnel and external veterinarians serving the State's livestock industries.

An issue of the *Livestock Health and Husbandry Report* for the year 1965–66, covering the work of the Division of Animal Industry, was produced and distributed to Departments of Agriculture, Universities and Agricultural Research Stations in Australia and many other countries. Production of Reports in this series had earlier been a regular activity of the Division but had been in abeyance since 1958.

Stock Foods and Medicines Act

Stock Foods.—Applications for registration of 2,100 stock feeds, submitted by 295 firms, were approved. Registration was not finalized for five products, and registration was not granted in one case because of failure to print labels in accordance with the Act. An increased number of overseas firms (particularly U.S.A.) registered fish meal, meat meal and soya bean meal.

Samples of 37 stock feeds were submitted by this Division to the Division of Science Services for analysis. The only detected breach was a water content of 30 instead of 25 to 27 per cent in a molasses sample. Four cases of sale of unregistered feeds were detected and appropriate actions taken.

Stock Medicine.—The Stock Medicines' Board considered 1,975 applications, as against the 1,804 applications in the previous year. The applications comprised 1,559 annual reapplications, 237 for products submitted for the first time, seven that were withdrawn, and two that were disallowed by the Board. In 160 cases provisional registration was granted pending submission of printed material as required.

Complete prohibition on registration of organo-chlorines remained in force, with the exception of DDT and BHC when used on pets and sold in quantities not exceeding 250 ml and in the form of a 10 per cent concentration.

Liaison was maintained with the Poisons Branch of the Health Department to enforce new regulations to the amended Poisons Act.

Increasing numbers of stock medicines manufacturers submitted their formulations in the metric systems.

Cattle Compensation Act

The Claims.—Claims approved for payment totalled 6,936; compared to 7,996 in the previous year. The total of cattle and carcasses for which compensation was paid and the aggregate payments also showed decreases compared to the previous year; the comparative figures being 9,182 against 11,192 and $312,483 against $364,125.

The Diseases.—Diseases for which compensation was paid and the amounts are in the following table:

Disease	Claims	Animals	Payments
			$
Tuberculosis	679	1,384	70,414.02
Cancer	3,678	4,768	152,340.82
Actinomycosis	2,039	2,328	70,496.09
Actinobacillosis	524	681	17,663.30
Pleuropneumonia contagiosa	4	6	538.00
Tick Fever	10	13	851.61
Trichomoniasis	Nil	Nil	Nil
Johne's Disease	2	2	179.20
Vibriosis	Nil	Nil	Nil
Totals	6,936	9,182	$312,483.04

The Claims Disallowed.—Statistics of claims for which compensation was disallowed were as follows: 108 for delayed notification of disease by owners; 48 for failure to notify disease; 15 for failure to pay levy or submit return; and one for delayed application for compensation; total 172.

Also, in 67 cases the amount of compensation payable was reduced becauce the claims were not submitted within 60 days of slaughter.

The Compensation Fund.—Income from levies paid by stock owners and by stamp duty on cattle slaughtered amounted to $325,352. Interest of $42,500 on $1 million invested was not received before the end of the financial year. Expenditure was $335,153. If the interest on the invested portion of the fund had been received in time, the balance at 30th June, 1968, would have shown $32,199 excess of income over expenditure.

Board of Tick Control—Cattle Tick Control

CATTLE TICK ERADICATION MEASURES

The Situation in Various Areas

Boonoo Boonoo Area.—An eradication campaign based on Cattle tick (*Boophilus microplus*) life history studies at Pretty Gully, and comprising fortnightly dippings for 6 months, started on 4th July and ended on 22nd December, 1967. The dipping programme was for three holdings. Cattle had been moved on to these from tick infested holdings in the Legume Area between September, 1966, and January, 1967. Four other similarly involved properties were leased, emptied of stock, for the period.

No untoward problem arose and the Area was released from quarantine on 22nd December, 1967.

Coutts Crossing Area.—This Area south of Grafton had become involved because of movement of cattle in October, 1966, from a tick infested holding in the Legume Area. It underwent a programme of fortnightly treatments from 11th May, 1967, to 4th January, 1968. Then the Area was released from quarantine on 5th January, 1968.

The two properties concerned have been kept under surveillance, and no evidence of tick life has been detected during the autumn of 1968.

Tick Fever

Reports indicated distinct improvement in the tick fever position during 1967–68. Four clinical outbreaks were confirmed: two (*Babesia argentina*) in the Tweed, one (*B. argentina*) in Woodenbong and one (*B. argentina* and *Babesia bigemina*) in Bangalow.

Only a single animal was involved respectively in the Tweed and Woodenbong incidence. The Bangalow incidence caused the death of three animals. Introduction of infected larvae from Queensland in a grass seed harvesting machine appeared to explain the outbreak.

Quarantine of Legume Area properties resulted from detection of carriers in Queensland-bred cattle introduced on to the holdings before the Legume Quarantine Area was established in January, 1967. In the Kyogle outbreak the carrier of *B. argentina* was detected on a suspect holding after testing for release from quarantine.

This year 27 holdings were released from quarantine. Quarantine on one holding had to be extended because of detection of a carrier when the herd was tested for release. Quarantine on four holdings was extended because of incomplete musters.

Complement-fixation testing was confined mainly to tick fever and adjoining holdings, and to a survey on tick fever incidence in Queensland cattle within the Legume Area. This survey also included the testing of cattle on holdings adjoining the one where tick fever was detected and where there was evidence that tick fever had spread to the New South Wales-bred cattle. This involved the testing of 1,489 head of cattle on six properties; results negative. Also, 636 cattle for movement into other Tick Quarantine Areas were tested. No reactor was detected.

As a result of the survey, restrictions on movement of cattle into other Tick Quarantine Areas—requiring a negative complement fixation test—were removed.

The apparent freedom from tick fever of cattle in the Legume Area, other than on the two properties quarantined, meant also that the boundary between Legume and Woodenbong Areas could be removed on 30th May, 1968. This is a saving on employment of staff for gating and patrolling the boundary.

During the 12 months blood samples from some 10,500 head of cattle were submitted to the complement-fixation test for tick fever.

CATTLE TICK CONTROL POLICIES

The Situation in Various Areas

The dipping policies for 1967–68 were altered, in that treatments east of the Richmond Range were reduced to six to make staff available to implement a four-treatment policy in Areas west of the Richmond Range.

Areas East of the Richmond Range.—As implied in the preceding paragraph, stock on holdings within the Richmond, Tweed and Kyogle Areas were given six treatments at 21-day intervals between 3rd October, 1967, and 6th February, 1968.

The dipping of all calves over the age of 4 weeks was enforced, towards offsetting the possible adverse effect of the reduced number of dippings. Seasonal conditions in the autumn were particularly favourable for tick life.

As shown by the following tabulation, the total of infestations in 1967–68 represented an increase. This reflected in part the increased attention to properties in problem areas. And it could reflect in part a suspected escape, in the Bangalow Section, of ticks from the Cattle Tick Research Station to at least 6 adjoining properties. In all, 11 properties in the vicinity of the Cattle Tick Research Station were found infested. There was also the 1 tick fever property in the Bangalow Section, where circumstantial evidence strongly pointed to the possibility of infected tick larvae having been introduced from Queensland in the seed harvester.

The increased total of infestations recorded was of some concern, because the change in policy whereby infested holdings are quarantined for a period of 21 weeks (in lieu of 9) resulted in fewer re-infestations being recorded than in previous years. This should be taken into consideration when studying the figures presented in the following tabulation of infestations:

Area	Number of Infestations Detected				
	1963-64	1964-65	1965-66	1966-67	1967-68
Richmond—					
Bangalow	19	35	2	3	18
Lismore	24	75	9	2	3
Nimbin	13	20	8	7	10
Casino..........	67	108	20	12	14
Rapville	..	3	..	..	1
Kyogle	60	53	5	3	7
Tweed	12	33	3	..	1
Totals	195	327	47	27	54

The greater concentration on problem herds to ensure complete musters, particularly in the Bentley Area, appeared to yield very promising results and the new policy for infested holdings presented no difficulties.

Areas West of the Richmond Range.—A policy of four treatments was started on 19th February, 1968, and ended on 19th April, 1968, without incident and with 100 per cent stockowners co-operating. This year most of the recorded infestations were in the Bonalbo Area.

In early April, 1968, by inspections in clean country, cattle ticks were found on one animal in a paddock east of and adjoining the lower Koreelah Creek. This caused gazettal of the Cullendore Quarantine Area on 17th April, 1968. Further examinations in the Cullendore Area failed to reveal cattle ticks, although cattle on two properties appeared to be tick-marked.

Detection of this outbreak necessitated considerable organization in gating and establishing suitable boundaries, as well as provision of dipping facilities. The clean country boundaries of this area were gated and manned on 10th April, 1968. Statistics of infestations recorded west of the Richmond Range are summarized in the following tabulation:

Area	Number of Infestations Detected				
	1963-64	1964-65	1965-66	1966-67	1967-68
Bonalbo	1	4	1	2	9
Tabulam	1	2	11	5	2
Rivertree..........	1	..	..	..	..
Woodenbong	..	13	2	..	..
Legume	..	..	..	7	..
Cullendore	..	..	..	..	1
Totals	3	19	14	14	12

Grafton and Copmanhurst Areas. The policy of examining moving stock continued. Also, stock on the holding at Fineflower, where an infestation was detected in June, 1967, were examined at 21-day intervals. No further evidence of cattle tick was detected.

Early in February, 1968, a single tick infestation was detected at Woodford Island, in the Grafton Area. Also, the owner had properties at Banyabba and Palmer's Channel. Cattle tick had been detected on his Palmer's Channel property in 1965 and assumption of transfer of ticks to Woodford Island was reasonable.

No further evidence of cattle ticks was detected at any of these places or on adjoining properties at Woodford Island. The cattle on the infested property were found clean at each of the four infestation treatments given, and a policy of examinations at 21-day intervals for 12 months has been implemented.

In the Copmanhurst Area very few voluntary treatments were undertaken.

Policy for Infested Holdings

Current policy requires that following four treatments at 21-day intervals (the last three to be clean) the stock shall be treated or examined at 21-day intervals on four occasions. During the 21 weeks of quarantine, movements off the infested holdings are to be subject to two clean treatments at 4- to 7-day intervals and are to take place on the day of the last treatment, except that for animals going to immediate slaughter only one clean treatment is required.

From the number of reinfestations recorded in other years it was obvious that the four-infestation treatments alone had not been sufficient to bring some infestations under satisfactory control. However, it is doubtful that the more stringent measures would offset the gradual deterioration in tick control likely to follow the reduction in number of policy treatments east of the Richmond Range. These should, even so, reduce the threat of development of strains of resistant ticks in problem herds.

Inspection of Stock at Abattoirs

Staff continued examination of stock at Macksville, Grafton, and Tenterfield abattoirs. Through the examinations at Grafton abattoir the single tick infestation on the animal from the Woodford Island property was detected.

The examinations continued to reveal *Haemaphysalis* sp. and *Ixodes* sp. ticks at Macksville and Grafton abattoirs, but there was no evidence of tick life at Tenterfield. The inspector at Tenterfield was again concerned in supervision of unloading of cattle arriving by train from Wallangarra, and dipping of all ex-Queensland calves prior to slaughter. He also checked, for tick life, cattle at the Tenterfield saleyards.

The inspectors at Casino and Byron Bay abattoirs examined the calf carcasses after skinning but found no cattle tick.

Slaughter of cattle from tick fever holdings and cattle from clean country also came under their supervision.

Examinations in Clean Country

In the autumn, mobile inspection teams made examinations in the area south of Grafton. No evidence of cattle tick was found. One of these teams operating in clean country, outside Legume Area, detected the infestation at New Koreelah reported earlier.

CLAIMS FOR COMPENSATION

Compensation claims ($9,608 in all) were paid for the loss of 209 head of stock by death or injury.

FENCING, DIP, AND HUT CONSTRUCTION

Quarantine boundaries were given constant attention and necessary improvements were effected. These included erection of about 27½ miles of new fence and repairs to 19¼ miles of existing fences. Again, fencing programme goals were seriously set back by the need to establish the Cullendore Quarantine Area after detection of ticks in clean country in the lower Koreelah Creek Area.

Much of the new fencing arose in establishing the Barcoongerie Line to permit of leasing and emptying of the country between this line and the southern Grafton Quarantine boundary, with a view to ultimate release from quarantine.

The dip gang constructed five new dips in the Grafton, Bangalow, and Tweed Areas, and was involved in repairs to Cullendore Area dips. Some 462 dips were repaired and 129 dipyards gravelled.

Sixteen new huts and five new tent units were built, 30 huts and cottages and nine tent units renovated and repaired, and 11 tent units roofed. Most of this work was in the areas west of the Richmond Range and Grafton Area.

STAFF

At 1st July, 1967, there were 507 ministerial staff; at the 30th June, 1968, the strength was 511. Although Boonoo Boonoo Quarantine Area was released during the year, savings in staff were offset by the need to engage additionals to re-establish Cullendore Quarantine Area.

Transfers effected during the year totalled 184; and turnover through retirement, resignation, death, or transfer to other branches of the Service totalled 38 men.

SUSPECTED ACARICIDE RESISTANCE

Detection of a heavy infestation in a problem herd at Clunes, in the Bangalow Section, about 2 months after the policy treatments, prompted sending of specimens of engorged ticks to the CSIRO, Yeerongpilly. This was to test for organophosphorus resistance. There being a faint suggestion that a percentage of the ticks showed a Ridgeland-type resistance, further ticks were collected from the property, but proved negative. However, the original findings were considered enough to warrant quarantine restrictions on this and two adjoining infested properties, and a fortnightly dipping programme.

Early in this programme the acaricide used was changed from delnav to ethion. Even after this change, there was no appreciable reduction in number of ticks found, until the cattle had had three treatments.

Possibly significant was that, at a number of treatments, cattle were found to be heavily infested on the head and neck—suggesting insufficient wetting of these parts. Observations during later dippings confirmed the suspicion that some of the cattle were able to prevent immersion of their heads in the dip. Head spraying was undertaken to overcome this.

In view of the findings it was decided that in the case of other heavy infestations samples of ticks should also be tested for resistance. This involved collection of ticks from five properties in the Kyogle, Casino, Lismore, and Bangalow Sections; all proved negative.

Sampling of ticks from the tick fever holding in the Bangalow Section also proved negative.

Queensland Border Control

INSPECTORIAL STAFF

Inspectors to control the introduction of Queensland cattle totalled 73; 66 full-time and seven part-time.

STOCK MOVEMENT STATISTICS

The following tabulations summarize the stock which moved across the border between New South Wales and Queensland.

From Queensland to N.S.W.

Administrative Section	Cattle	Sheep	Pigs	Horses	Goats
Stanthorpe	97,875	15,817	38,439	1,868	390
Goondiwindi	91,376	394,686	299	4,540	606
West of Mungindi	29,091	291,662	1	2,331	972
Totals	218,342	702,165	38,739	8,739	1,968

From N.S.W. to Queensland

Administrative Section	Cattle	Sheep	Pigs	Horses	Goats
Stanthorpe	25,856	372,394	1,032	1,791	6
Goondiwindi	41,459	470,036	929	826	1
West of Mungindi	3,115	139,367	..	536	..
Totals	70,430	981,799	1,967	3.153	7

CONDITIONS OF ENTRY INTO NEW SOUTH WALES

Because of multi-resistance ticks in Queensland, all dips at the Queensland border had to be charged with an acaricide effective against this type of tick, and dursban was used. This acaricide was also introduced to spray horses introduced but exempt from dipping.

The minimum period between treatments of stock introduced into New South Wales was reduced from 5 to 4 days. Conditions for introduction of hides from Queensland were also modified.

CONSTRUCTIONAL WORK AT THE BORDER

In association with Queensland's Darling Downs-Morton Rabbit Board, 2½ miles of replacement fencing was erected on the combined rabbit-tick fence separating in part the two States. A bulldozer was used to clear 6½ miles of vehicular track adjacent to the border fence.

One camp unit was constructed and eighteen gatekeeper cottages were renovated. A new office was built at the Wallangarra gate. The old office was re-sited for use as a camp unit.

A new spray yard, with crush, and two motor ramps across the border were built.

Meat Inspection Service

STAFF

The establishment strength at 30 June, 1968, comprised the principal veterinary officer (M.I.) and assistant principal veterinary officer (M.I.), two veterinary officers, one senior supervising meat inspector, 205 meat inspectors (all other grades), 20 brand boys, and 2 office assistants (female).

ACTIVITIES OF THE MEAT INSPECTION SERVICE

Ante-mortem Inspections

At Homebush Saleyards, ante-mortem inspection of cattle was done three times weekly and pigs once weekly. All cattle were inspected on arrival at Homebush Bay Abattoir.

All animals at all works were inspected before slaughter. Stock submitted at all abattoirs for emergency slaughter were also examined before being killed.

Post-mortem Inspections

Post-mortem inspection was done at time of slaughter at Homebush Bay State Abattoir, Riverstone Meat Works, two small licensed meatworks in the metropolitan area and at the following country centres: Aberdeen, Berrima, Blayney, Byron Bay, Casino, Dorrigo, Dubbo, Forbes, Goulburn, Guyra, Gunnedah, South Grafton, Inverell, Moree, Mudgee, Macksville, Orange, Tenterfield, Wagga Wagga, Wallangarra, Wingham, and Yanco.

Other Inspections

Horses were inspected at post-mortem in one pet food knackery.

All meat introduced into the metropolitan abattoir area was re-inspected. The handling of meat at meat markets in the metropolitan area was supervised from the sanitation standpoint.

Some 387 shop inspections were done by meat inspectors. Smallgoods factories also were inspected.

Total Slaughtering at Abattoirs where State Inspectors are Located

	Cattle	Calves	Pigs	Sheep
State Abattoir	95,295	80,763	170,302	2,172,519
Inside County of Cumberland*	16,190	30,877	25,961	665,790
County Areas*	482,035	171,994	474,641	3,935,106
Totals	593,520	283,634	670,904	6,773,415

* Excludes export.

For Export the slaughterings comprised: 19,592 cattle *inside County of Cumberland* and 146,594 *in country areas,* a total of 166,186 cattle; 4,176 calves *inside County of Cumberland* and 37,845 *in country areas,* a total of 41,521 calves; 696 pigs *inside County of Cumberland* and 2,723 *in country areas,* a total of 3,419 pigs; and 264,374 sheep *inside County of Cumberland* and 1,255,402 *in country areas,* a total of 1,519,776 sheep.

Also, at knackeries 5,234 horses were slaughtered.

Carcasses Totally Condemned

Reason	Cattle		Calves		Pigs		Sheep	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Actino	9	0·002	..	..	..	..	..	..
Arthritis	66	0·011	138	0·049	1,864	0·277	2,944	0·043
C.L.A.	..	..	..	..	..	..	1,824	0·027
Cysticercus ovis	..	..	..	..	..	..	351	0·005
Emaciation	250	0·042	34	0·012	12	0·002	24,939	0·368
Sarcosporidiosis	..	..	..	..	..	..	1,522	0·022
Septic Conditions	183	0·030	64	0·022	704	0·105	404	0·006
Tuberculosis	354	0·060	2	0·001	99	0·015	..	..
Other Conditions	740	0·125	763	0·269	512	0·076	4,268	0·063
Totals	1,602	0·270	1,001	0·353	3,191	0·475	36,252	0·535

Carcasses Partially Condemned

Reason	Cattle		Calves		Pigs		Sheep	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Actino	12,906	2·174	15	0·005	..	..	..	..
Arthritis	1,979	0·333	57	0·020	4,468	0·666	10,275	0·152
C.L.A.	..	..	..	..	..	..	16,435	0·243
Cysticercus ovis	..	..	..	..	..	..	..	..
Emaciation	..	..	..	..	..	..	..	..
Sarcosporidiosis	..	..	..	..	..	..	3	..
Septic Conditions	166	0·028	9	0·003	303	0·045	491	0·007
Tuberculosis	404	0·068	1	..	209	0·031	..	..
Other Conditions	6,245	1·052	75	0·026	9,778	1·458	4,573	0·067
Totals	21,700	3·656	157	0·055	14,758	2·200	31,777	0·469

Cattle and Sheep Liver Condemnations

Based on a random sample survey of 24,000 cattle livers (2,000 per month) and 48,000 sheep livers (4,000 per month) the condemnations were: 16.5 per cent cattle livers and 8.6 per cent sheep livers *for fluke infection;* 15.2 per cent sheep livers *for Cysticercus teniucollis;* 1.1 per cent cattle livers and 6.6 per cent sheep livers *for hydatids;* 1.0 per cent cattle livers *for telangiectasis;* 0.4 per cent sheep livers *for caseous lymphadenitis;* 1.3 per cent cattle livers *for abscesses;* 0.02 per cent cattle livers and 1.3 per cent sheep livers *for melanosis.*

Meat Introduced into the Metropolitan Abattoir Area

Quantities of meat inspected after introduction into the Metropolitan Abattoir Area were as follows:

From within N.S.W.—beef: carcasses 364,330, piece meats 7,331,163 lb; *veal*: carcasses 153,211, piece meats 194,475 lb; *pork*: carcasses 383,703, piece meats 1,422,092 lb; *mutton*: carcasses 3,476,421, piece meats 1,767,754 lb; *bacon*: piece meats 992,481 lb; *sundries*: 11,494,445 lb; and *goat*: 2,346 lb.

From outside N.S.W.—beef: carcasses 99,609, piece meats 6,304,956 lb; *veal*: carcasses 91,790½, piece meats 345,124 lb; *pork*: carcasses 79,675, piece meats 4,361,470 lb; *mutton*: carcasses 169,789, piece meats 678,964; *bacon*: piece meats 2,191,162 lb; and *sundries*: 1,125,752 lb.

Service Under Commonwealth Quarantine Act

Division of Animal Industry continued to administer certain sections of the Quarantine Act, 1908–1966, for the Commonwealth Government. Two additional port inspectors were appointed to Sydney. Two veterinary officers and nine port inspectors now do the quarantine work at Sydney and Port Kembla. The District veterinary officer and one port inspector do the work at Newcastle.

IMPORT INSPECTIONS

Animal Imports

Importation of cattle, sheep, goats and pigs into Australia remained totally prohibited. And routes by which horses could be imported from the U.K. remained restricted to through the Panama Canal with transhipment at New Zealand ports.

In almost all classes of permitted animals the imports were higher than in the previous year. The one exception was birds from New Zealand, wherein the considerable decrease was because fewer day-old chickens were imported.

Three attempts to smuggle birds into N.S.W. by air from overseas were detected. Illegal removal of an animal from a ship at Newcastle was also discovered.

Imports of Animal Products

Imports of hides and skins, furred skins, raw shells, animal hair, feathers and cheese increased. Imports of chilled and frozen meats from New Zealand also increased; and most came by air transport. Imports of meatmeal and fish meal continued to increase. Stockfeed concentrates deceased.

Greater control was exercised over the importation of biological material and laboratory media. Thus, increased quantities came under notice.

The import quantities of hide pieces, casings, wool and tinned meats decreased.

Illegal importation of tinned pigmeats from the East was investigated and 1,621 tins (767 lb) were seized from one shop in Sydney.

Passengers' Baggage

Co-operation with Customs officers continued, in searching for illegal goods in the baggage of passengers arriving by sea and air. Considerable quantities of prohibited imports such as salami, other meat products, egg noodles, edible birds' nest, homemade cheese and other foods were seized.

This type of illegal importation is a growing problem, through continued increase in passenger arrivals. In 1967–68 there were 88,597 passenger arrivals by ship, and 409,611 by air; compared with 87,101 and 294,688 in 1966–67.

Disinfection of Footwear and Clothing

Disinfection of footwear and work clothes owned by incoming air passengers who had had an association with rural industries in foot and mouth disease countries, continued. This year 2,388 pairs of shoes were disinfected and 176 clothing articles were detained for laundering; from 1,124 such passengers.

During a 3-day emergency in May when foot and mouth disease was suspected to exist in New Zealand, the near to 10,000 pairs of shoes of the 2,195 passengers who arrived from New Zealand were treated.

Clearance of Service Personnel

In co-operation with Department of Customs and Excise, a quarantine officer accompanied Customs officers to Townsville to board the H.M.A.S. *Sydney* for clearance of returning Australian Army personnel and the vessel's crew, to facilitate subsequent disembarkation at Sydney.

A quarantine officer went to Jervis Bay to check on the unloading of the aircraft from H.M.A.S. *Melbourne*, and to co-operate with Customs officers in clearance of the vessel's crew. A number of smaller naval vessels were cleared on arrival at Garden Island.

The first aircraft associated with rest and recreation leave for U.S. servicemen arrived at Sydney on 4th October, 1967. The servicemen were cleared through Customs in exactly the same way as other air passengers from overseas. Small quantities of tinned meats and other foods of animal origin were seized. Soiled footwear was either disinfected or detained for collection on departure.

Parcels Post

The volume of goods arriving from overseas by parcels post and subject to quarantine control remained considerable. Centres of introduction were Sydney, Newcastle, and Port Kembla. Many items of exotic food of animal origin were seized. The total of falsely labelled tinned meats and undeclared items continued to increase.

Under strict quarantine control a number of trade samples of normally prohibited materials were imported for analytical examination to enable local manufacturers to study and keep abreast of overseas developments.

Supervision of Ships' Pets

Supervision of pets on overseas vessels visiting Sydney and Newcastle remained strict. On a number of occasions ships' officers had to be directed to tighten their precautions against escape. In one instance a Ship Master's bond was estreated because the pet had escaped.

Export of Animals

The continued control over export of animals involved inspection and, in some cases, treatment supervision.

Export of day-old chickens decreased for the fourth year in succession, although less so this year. Cattle, sheep, horse, and cat export totals also decreased. Goat, pig, bird and aquarium fish exports increased. Dog exports totalled much the same as in the previous year; 1,490 were exported, to 36 countries. The main exports of dogs were 512 to the U.S.A., 297 to Hong Kong, and 173 to New Zealand.

Pastures Protection Section

STAFF

New Position: Research Officer (Noxious Animals)

A veterinary graduate was appointed to the newly established position of research officer (noxious animals). Initially, he is in a period of training with the CSIRO, Canberra.

Field Officers

The "Field Officer, Sydney" position was transferred to Armidale, and appointments were made to vacant positions at Wagga and Armidale. The establishment of Pastures Protection Section field officers is now at full strength.

Pastures Protection Boards Staff

Staff particulars are as follows:

	At 30th June, 1967	At 30th June, 1968
Veterinary Inspectors	35	33
Pastures Protection Board Secretaries	56	58
Rangers	66	65
Rabbit Inspectors	74	73

With regret, the death of Mr G. E. Charles, Veterinary Inspector, Camden, is recorded.

In-Service Training

Rabbit Control Schools. Two schools for training rabbit inspectors in the use of sodium fluoroacetate ("1080") rabbit poison were conducted this year, one at Moss Vale and the other at Mudgee.

It has been decided that such schools in future should be restricted to instruction in the handling and mixing of "1080" and general rabbit biology and control, and that refresher courses be held only for rabbit inspectors who have done at least 12 months' service after having attended a "1080" school. The first such course was held at Hawkesbury Agricultural College in May, 1968.

Extension Methods. One field officer attended the Extension Methods School conducted by the Department.

PLAGUE LOCUST CONTROL

The 1967–68 drought restricted the activity of plague locust, with the result that field officers were little involved in control measures.

There is a detailed account of plague locust incidence and allied work in the report of the Division of Science Services Entomology Branch (page 98).

TRAVELLING STOCK RESERVES

The scheme dealing with applications for travelling stock reserves has been altered to enable outstanding applications to be dealt with more expeditiously. Those outstanding at the end of June, 1968, were applications for which further information was awaited from Pastures Protection Boards.

MOLONG PASTURES PROTECTION BOARD POSITIONS

Sufficient nominations were received for the Director positions on Molong Pastures Protection Board. The Board was elected at the General Election held in September, 1967. The Pastures Protection Officer handed over to the new Board early in October, 1967.

Livestock Health—Research

VETERINARY RESEARCH STATION, GLENFIELD

Brucellosis (Cattle)

Strain 45/20 Vaccines. Two commercial vaccines were tested, with not very encouraging results. One vaccine failed to produce an agglutination response in cattle. The other produced some agglutination response in adult cattle, more pronounced after the second injection. Agglutination titres never rose above 1/40 (less than 100 I.U. of antibody).

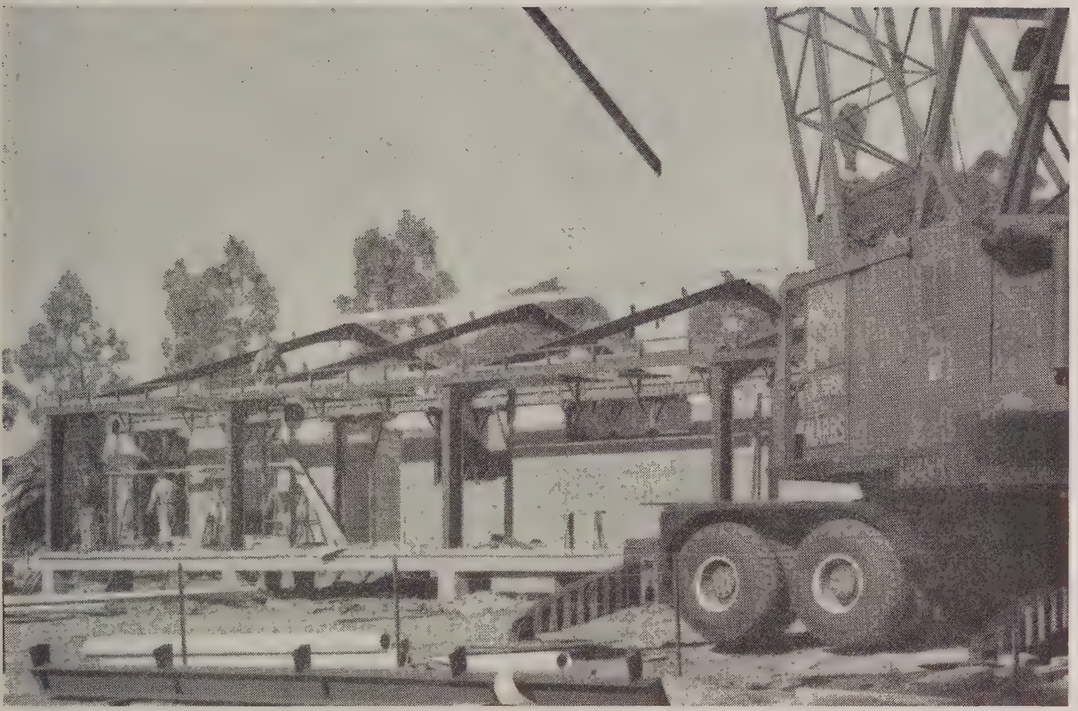
Both failed to protect guinea pigs against either 500 or 5000 *Brucella abortus* strain 544 organisms. They also produced large local reactions in cattle at the site of injection even though the vaccine was deposited deep in the musculature. The local reactions which developed after the second injection were much more pronounced although adult animals appeared to be affected more than calves.

The vaccines produced a marked febrile reaction. This started a few days after vaccination and persisted for 48 hours. Milk production declined for a short period and returned to normal in all but one cow. The latter's milk yield dropped about 50 per cent.

Rapid Whole-Blood Test. A rapid whole-blood plate agglutination test was examined initially in a small number of Str. 19 vaccinated cattle and later in 3 naturally infected herds which had no history of vaccination. Three stained antigens were employed, using different concentrations of cells (11 per cent, 8 per cent, 4 per cent). The tests were read at 2 minutes on an illuminated plate. The best correlations with the serum agglutination tube test were obtained using the 11 per cent and 8 per cent cell antigens. The reactions given with the 8 per cent antigen were slightly the more obvious.

Mastitis: Udder Excretion Times of Antibiotics

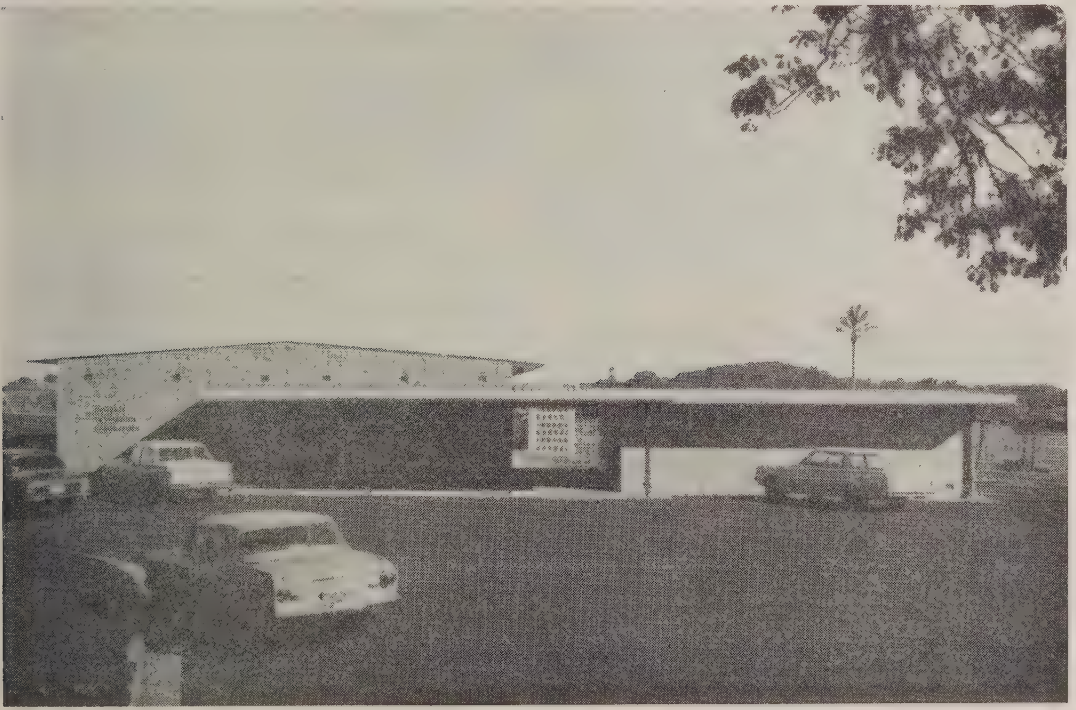
Following reports of prolonged antibiotic excretion times in some herds, investigations were made in association with Division of Science Services to ascertain excretion times for various antibiotic formulations. The results were of interest and are on record in appropriate papers.



Two New Veterinary Laboratories

Above: At Glenfield the new virology, serology and offices wing is under construction. Including full equipment costs this will have been a $517,000 project when completed.

Below: At Wollongbar the new District Veterinary Laboratory to service north coast areas was opened in May, 1968. When fully equipped this will have been a $170,000 project.



Darling Pea Toxicity Studies

The pathology of Darling Pea (*Swainsona* sp.) poisoning in sheep was investigated, using formalin-fixed organs of affected sheep. After examining lipid, carbohydrate and stained sections it was concluded that the plant causes stimulation of neuronal cytoplasm synthesis that results in marked neuronal hypertrophy. Associated with prolonged intake of the plant or with recovery from the initial neuronal damage, there is a focal axonal dystrophy. This lesion is best developed in chronically affected sheep.

Newcastle Disease

Haemagglutination inhibition (HI) tests applied for survey purposes indicated a continuing high level of reactors in the poultry population. Variations from last year in affected individual properties suggested both new infections and loss of infection, on a property basis.

A trial to examine the produce of infected hens failed to demonstrate the presence of virus in eggs or the chickens hatched. But this result is of limited value because: (i) there was a marked reduction in egg production after inoculation of hens with NDV, so there was only a small amount of produce to examine; (ii) some of the hens (6/10) failed to develop HI antibody, indicating that the per oz inoculum at the rate used was inadequate.

A trial to examine the seasonal incidence of non-antibody haemagglutinin inhibitors had not given useful results by the end of the 12 months under report. One attempt to titrate inhibitors showed only low levels in small numbers of samples, possibly because of loss of inhibitor activity with storage, or because of use of a low titre haemagglutinin. Inhibitors were found to be best demonstrated by high titre haemagglutinins.

In one flock the H.I. titre was found to persist for the economic life (2 years) of birds which were originally positive, with no noticeable fall in titre. In another flock observations on the H.I. reactor incidence showed that young stock were failing to develop a titre and that Newcastle disease virus had not spread during 1967 in this flock.

Infectious Laryngo-tracheitis (ILT)

Some 750 sera were tested in neutralization tests in embryonated eggs. The tests were mainly applied for the survey of flocks under observation in Tamworth district. Sera were usually tested as pools of four to six individuals and results were very satisfactory, in that equivocal results were rare. Pools of sera almost invariably showed either no neutralization or reduction of virus titre by several logarithms.

ILT virus titrations were made to check on titres of vaccines used in all vaccine-in-drinking water trials and to check titres of all samples of virulent virus used for challenge. Considerable variations from their normal titres, in both, indicated this check is needed in any bird inoculation work.

Titrated stocks of ILT viruses were prepared from three strains from affected flocks in the Tamworth district, from a strain received from Western Australia for identification and virulence tests, and from the Glenfield standard strain used in neutralization tests. Two Tamworth strains were identified by serum neutralization tests and one by chorio-allantoic membrane histopathology. Other titrations included tests to determine the effects of a polymer on ILT virus.

An attempt to produce a large bulk of precipitating serum for use in the ILT gel diffusion precipitin test was not successful when birds were given an abbreviated course of immunization.

Experiments were done with iodine fumes produced by evaporation of iodine water solution and iodine crystals as preventative treatments for ILT. The method did not prove satisfactory. The fumes failed to spread in the pens at ground level or become inhaled by the chickens.

An improved slide smear technique was compared with histopathological examination for diagnosis of ILT. The former was correct in 78 per cent of a sample of field cases and in 63 per cent of a group of experimentally infected birds.

Five challenge trials in co-operation with the University of Sydney compared the efficiency of eye-drop and drinking water routes of vaccination. The drinking water method showed enough promise for further investigation.

Psittacosis Lymphogranuloma Venereum (P.L.V.) Group Agents

Sporadic bovine encephalomyelitis (SBE) was induced in mild to sub-clinical form in 3 young cattle. These have been observed over 12 months, for development and persistence of complement fixing (CF) antibody. Sera collected in large volume at peak titre were used to establish substantial stocks of freeze dried control sera.

PLV were recovered from sheep affected clinically with a rheumatic febrile condition (clinical polyarthritis?). Two typically affected sheep, including one from which PLV were recovered from blood during the febrile phase, are being held for serial bleeding to demonstrate the persistence of CF antibodies. A serum enzyme analyses on field samples had shown some abnormal values; experimental sheep were inoculated to provide material for serum enzymology.

Ephemeral Fever

Mild but typical cases of ephemeral fever were induced in inoculated cattle, using material from 3 sources. The 3 experimental animals, and a further young animal in which transmission from a fourth source was doubtful, completely resisted challenge by a 1956 strain of virus obtained from the CSIRO, Melbourne. Three control animals and 3 others in which transmission from field material was considered to be negative, developed typical ephemeral fever after challenge by the 1956 strain. Further transmission work was curtailed by occurrence of natural ephemeral fever in local cattle.

The 1956 strain and two 1968 strains were stocked as blood buffy coat samples, both wet-frozen in liquid nitrogen and freeze dried. Samples of buffy coat from animals infected with these three strains have been supplied to the Australian National University for attempts to adapt the agent to baby mouse brain. At the same time attempts were made to adapt two 1968 strains to baby mouse brains at Glenfield. No disease was recognized after eight passes. The attempt was not pursued further.

Stocks of reference sera, including pre-inoculation and convalescent pairs, were taken from all transmission animals. Portions of these were supplied to the Australian National University. In addition, where sera from field cases could be obtained as pairs and CF tests for PLV excluded SBE from the diagnosis, these pairs were held frozen as reference sera—for possible use if a neutralization test in baby mouse brains becomes available with an adapted strain.

Bovine Malignant Catarrh (BMC)

Transmission of BMC was achieved for the first time in New South Wales and the disease was carried to a second laboratory pass, infecting one of two animals. Further passes were not successful. First and second passes were each achieved by the concurrent inoculations of synovial and serosal fluids subcutaneously, blood intravenously, and tissue homogenates intraperitoneally. Disease developed after incubation periods of 18 and 16 days.

Transmission of the disease to rabbits was attempted with cell cultures prepared from two naturally affected animals. To favour the implantation some of the rabbits were maintained on a 6-mercaptopurine medication as an immune suppressant, for pre- and post-inoculation periods. Disease was not induced in the rabbits.

Pleuropneumonia Contagiosa (PPC)

Because of occurrence of false reactors in the complement-fixation (CF) test for PPC, 12 reacting animals were transferred from property of origin to Glenfield for an investigation. Their serological reactions were considerably reduced between time of field sampling and the Glenfield arrival sampling. Rate of decay of the complement-fixing activity was too high to be due to normal gamma-globulin decay but the reason was not discovered.

Sheep Pneumonia

Serological surveys were done in a pneumonia-affected and a pneumonia-free Border Leicester stud flock, to relate antibody rises to pneumonia occurrence in individuals, but pneumonia did not occur in either group.

The genetic aspects of susceptibility to pneumonia became of interest. To test the practicability of assessing susceptibility by post-mortem lesions in slaughter groups, rather than by morbidity and mortalities in total flocks, some weaners from Cowra Agricultural Research Station's breed/production experiment were examined at slaughter. Preliminary findings showed a clear distinction between incidences within breeds.

It seemed that high incidence of lesions might be expected in clinically normal individuals in susceptible groups. Pathological examination of lungs showed a possible anatomical basis to susceptibility.

Test for Swine Erysipelos

An agglutination test for *Erysipelothrix rhusiopathiae* was established. The antigen was prepared using a medium and method recommended by the Director of the Veterinary Research Institute, Parkville. The antigen appears to be quite stable and can be stored for over 12 months. This test procedure is not yet available for routine use. More work is needed, to determine the significance of reactions.

Q Disease (Poultry)

The cause is still not known. A virus was isolated on two occasions from brain, liver, and kidneys, but did not reproduce the disease when inoculated into chickens. Histological examination of various tissues showed no change suggestive of viral infection.

Pullorum Disease

Examination of Rapid Whole Blood Stained Antigens. Work continued under the direction of the Technical Subcommittee on Pullorum Disease. A reactor flock comprising birds infected with standard and variant strains was established. Standard positive and negative sera were produced and distributed to commercial laboratories.

Comparative rapid whole-blood testing using Canadian and Australian antigens was done on two infected flocks. The superiority of the Canadian antigen was demonstrated. Antigen manufacturers produced 10 batches of antigen to Canadian standards and these were examined to a set of standards developed by the Technical Subcommittee. Recommendations on standards and the use of colour prints of reactions to standardize field readings were made to the Subcommittee.

Non-specific Reactor Problem. This problem was of minor importance in the field, except in a government flock where evidence indicated *Escherichia coli* was responsible for cross-reaction with pullorum antigen. The *E. coli* appeared to be cross-reacting with the 12_2 antigenic factor. Antigens were prepared from *Salmonella strasbourg* and from the standard strain of *S. pullorum* in an attempt to detect the pullorum infected birds. The presence of the variant strain of *S. pullorum* in the flock made this approach difficult.

Cross-reactions to pullorum antigens were also given by *S. typhimuriam, Proteus* sp., and sera from *Brucella abortus* infected cattle.

Incidence of Variant Strains of S. pullorum. Typing has been limited to the use of *Proteus* antiserum. Most of the isolates (10) typed in the last twelve months were either intermediate or variant types.

Paratyphoid

In co-operation with private veterinarians an eradication programme was developed in a commercial poultry breeding flock. Determination of infection reservoirs on that farm resulted in isolation of *Salmonella typhimurium* from rats and mice, domestic animals and the environment. *S. typhimurium* was also isolated from dead-in-shell embryos at the hatchery.

Emphasis was on determining the role of the by-products plant as a source of infection. Preliminary examination of the jute sacks did not yield *S. typhimurium,* but a Group C *Salmonella* was isolated.

Reactors and non-reactors from the commercial breeding flock were housed at Glenfield. Serological reactions using rapid whole blood and tube antigens prepared from homologous and imported strains were compared with infection as assessed by cloacal swabs and culture of the viscera. Preliminary results indicated poor correlation. There were many non-specific reactions.

Cysticercus bovis

Culture methods developed at the University of California successfully isolated *Mycoplasma* sp. from chickens and turkeys. Identification of the isolates had not been completed. *Mycoplasma gallisepticum* grew successfully in the medium. Attempts to develop an antigen are proceeding.

Sinusitis in Ducklings

Investigation of a sinusitis with nasal discharge in day-old ducklings resulted in successful transmission of the disease.

Meningo-encephalitis in Chickens

An organism resembling *Flavobacterium meningio-septicum* was isolated from the brain of chickens showing nervous symptoms. The disease was reproduced by intracerebral and intranasal instillation of the organism.

Rupture of Chickens' Gastrocnemius Tendon

This condition was recorded for the first time in New South Wales and possibly Australia. It was in nine-week-old broiler chickens. Incidence in the flock was low, but the syndrome is of interest for its suspected genetic aetiology.

Biochemical Techniques

Bilirubin Determinations. Modification of the method to determine bilirubin was adopted after studying reaction times. Increased accuracy resulted. Special cams were prepared for mechanical plotting of protein components of serum following electrophoresis.

Copper Analysis. The procedure for copper analysis was modified by adoption of a colour reagent (zinc dibenzyle dithiocarbamate) specific for copper. The procedure was thereby simplified. Two steps in it have been eliminated.

Lipid Determination. Further progress was made in the application of two-dimensional paper chromatography for lipid determination in biological materials.

Serum Glutamic Oxaloacetic Transaminase (SGOT). The commonly used method was found to require modification to avoid underestimation of high levels of activity. Conditions to provide satisfactory sensitivity and accuracy were defined.

Serum Ornithine Carbamyl Transferase (SOCT). Two procedures were compared for accuracy, sensitivity, precison, ease of performance and cost. The method measuring citrulline synthesis proved to be more precise, more easily performed, and cheaper than that measuring citrulline arsenolysis.

As ascertained previously, SOCT activity was as sensitive as SGOT in indicating liver cell necrosis.

Sera from cattle with undiagnosed scouring gave interesting results. Although SGOT values were normal. SOCT values were up to ten times normal. This suggested that SOCT activity in such cases arises from tissues other than the liver. As a result of this finding, OCT activity in other tissues was examined. High activity was found in the fundic region of the abomasum, and lower activity in the mucosa of the pyloric region and duodenum.

Serum Creatine Phosphokinase (SCPK). A suitable colourimetric technique was developed, and reaction conditions defined. Activity was found to be elevated in cases with muscular and central nervous system disturbances.

Serum Alkaline Phosphatase (SAP). Using sera from normal cattle and sheep, the colourimetric and spectrophotometric methods were compared. They were similar in overall efficiency, ease of performance, and cost.

Isoenzyme activity was investigated in 16 tissues. The work indicated that activity from liver or intestine can be satisfactorily identified. Elevated levels were obtained from sera of animals with hepatic or intestinal disease.

Serum Pepsinogen. Minor modifications have been made to the procedure. The difficulty of interpretation of results from field samples remained, but abnormally high results appeared to be of diagnostic value.

Cysticercus bovis

A survey to assess *C. bovis* incidence in slaughter cattle in New South Wales was continued. Of the 257 lesions examined, 19 proved positive for presence of recognizable scolex. Many of the unconfirmed lesions submitted were probably degenerating *C. bovis* but positive diagnosis was not possible.

Worms in Cattle

Results from three successive calf drops on north coast properties became available. Despite seasonal differences, incidence of nematode parasites as judged by faecal worm egg counts and worm counts of slaughtered animals was similar in the three calf drops. *Cooperia* spp. were the most prevalent parasites. *Ostertagia, Haemonchus, Trichostrongylus axei, Oesophagostomum* and *Bunostomum* were present but in much lower numbers. Incidence of *Cooperia* was highest in beef calves in the post-weaning period. Thereafter a fairly strong resistance to re-infection developed.

A comparison of liveweight gains of groups of calves treated monthly with thiabendazole showed a 60 to 70 lb liveweight advantage over untreated groups at joining at two years of age. Differences in body weights between these groups were mainly in the post-weaning period, but the major cause seemed poor nutrition rather than parasitism. In beef herds a single anthelmintic treatment at weaning showed no production advantage.

On a property being studied in the eastern Riverina ostertagiosis broke out in August/September, 1967. Worm counts in slaughtered animals indicated a marked increase in arrested development of *Ostertagia* commencing at that period. After this period a production advantage of about 80 lb liveweight occurred in a group of calves treated monthly throughout with tetramisole.

COLIN BLUMER DISTRICT VETERINARY LABORATORY, ARMIDALE

Weaner Illthrift

This project was continued with a new lamb drop at the Shannon Vale Nutrition Station. The illthrift in lambs following weaning could be attributed to an inadequate plan of nutrition, at least in the circumstances of this trial. Parasites did not play a marked role.

Worms

Cattle.—Surveys of seasonal parasitic changes were continued at Glen Innes Agricultural Research Station and were started also on three other properties.

Sheep.—Determination of parasite levels in sheep in the various experimental groups at Shannon Vale Nutrition Station continued. The results are primarily of value to the Shannon Vale management.

Salmonella Survey at Poultry Abattoirs

Culture work continued, for isolation of *Salmonella* species from poultry abattoir wash tank water. *Salmonella* other than *S. pullorum* were not isolated. This is at variance with the results at Queensland abattoirs. Cultures in that work were made from the drip of thawing birds.

Vaccination Against Cattle Enterotoxaemia

To determine cause of severe mortalities in young cattle on excellent pastures, and to assess the value of vaccinating for enterotoxaemia to control these losses, a trial was commenced on a property affected. Cattle in the trial received enterotoxaemia vaccine either type O, or types D and C together. Serum antitoxin levels are being determined at the Commonwealth Serum Laboratories, Melbourne.

Salmonellosis

From rats on a large turkey farm, which had experienced turkey mortality due to *Salmonella singapore*, this organism was isolated.

CATTLE TICK RESEARCH STATION, WOLLONGBAR

Tick Fever (Babesia sp.) Studies

Improving on the Complement-Fixation Test.—Although the complement-fixation (CF) test for *Babesia* sp. has been of great value, helping the detection of some 300 carriers among 125,000 animals in the past four years, it suffers the disadvantage of showing as positive about 1 per cent of animals which are not infected. The cross-checking thus needed has caused delays in final diagnosis and greatly raised the costs overall.

Work is constantly directed towards improving the CF test or finding alternative methods for rapid cross checks. The conglutination test adapted for *Babesia* has shown some promise.

Laboratory Studies of Babesia sp. Transmission.—Attempts to transmit *Babesia* sp. with tick numbers below 50 have not succeeded, although the history of outbreaks adjoining the Queensland border suggests that it occurs.

Improving Babesia Strain Identification.—Work continued in an attempt to produce an improved method of identifying different strains of *Babesia argentina*, based on the agglutination reaction of infected red cells.

Cattle Tick Life History Studies

Results from Five Years Observations.—The results of 5 years observations on the life history of the cattle tick (*Boophilus microplus*) at 10 sites in different but representative localities were prepared in 1967 for publication. The work has:

(i) Shown that failure of the 1956–57 eradication campaign could not have been due to the long life of the tick. It points to the dip fluid then used as the most important cause of failure of the campaign.

(ii) Allowed an understanding of the probable survival time for the progeny of ticks falling from cattle in any district and season.

(iii) Demonstrated the influence of shade on tick survival. The shade of trees killed ticks in winter, but preserved the lives of colonies in summer—particularly in the drier parts of the Tick Quarantine Areas.

Tick Dispersal Studies.—Knowledge of tick dispersal has been advanced partly by the discovery of suitable long-lasting tanglefoot material to allow trapping. Two suitable materials were chosen after weeks of field experiments.

A 12-acre field at Wollongbar was emptied of cattle and ticks. A strip of pasture immediately outside the fence was artificially infested heavily. Thousands of tick larvae were found to invade the tick free pasture as far as 10 feet, hundreds to 50 feet, and one larva was found at 100 feet.

Bait animals, exposed in pairs, in 30 weeks bred 59 female ticks, the larvae of which must have travelled at least 100 feet. A second series of pairs in 22 weeks dropped nine ticks, the larvae of which must have travelled at least 265 feet.

Private farms adjoining the Cattle Tick Research Station became tick-infested in 1968, presumably because the widening of the buffer from 12 to 100 feet in 1965 proved insufficient to intercept all dispersing larvae in a season unusually favourable to tick life. Preparations for widening the buffer to 5 chains were well in hand. The buffer was at all times stocked with weekly-dipped cattle.

Birds and dogs were shown to be able to carry small numbers of larval ticks as passengers for several hundred yards. The Queensland Border was studied with this information in mind. For the greater part of its distance the border is secure because of mountains, forests and banana plantations but in some short lengths the border buffer, normally 1 chain wide, should be widened from its normal 1-chain width.

Treatment and Infestation Histories Studied.—The special study of a group of small properties with a history of repeatedly recurring infestations in the past decade, was continued from 1966–67 into 1967–68. Dipping complete musters at 21-day intervals in organo-phosphates was extremely effective. Treatment was continued throughout the year, or with a 3-months interval in winter (owner choice). Infestations dwindled. The last tick seen was in November, 1967.

The records of all known infested properties east of the Richmond Range were studied because it could be seen that 2 years of dippings on a policy of nine at 21-day intervals had reduced known infestations from 298 in 1965 to 32 in 1967.

Consideration was given to whether the intensified control of 1965 and 1966 had so approached eradication that a continued and more severe pressure on the tick population could achieve a cleansing of large blocks of country or even the whole Quarantine Area. The resultant opinion is that although the policy of nine treatments in organo-phosphate dip fluids at 21-day intervals had achieved a striking reduction in tick population, there were probably unobserved infestations. These would come into view if control were relaxed.

Acaricide Studies

Influenced by the presence of multi-resistant ticks in Queensland, work was directed at assessing the importance of residues in meat, should the acaricides have to be changed; and to studying the effectiveness of newer acaricides. The analytical work was done by the Board of Tick Control laboratory, Lismore (see later).

The most efficient available acaricide for multi-resistant ticks, dursban, was studied more thoroughly than others. It appeared to present no important residue problem (although American work has shown it to be extremely persistent in soil). Its efficiency is not reduced by rain after application, but rather surprisingly it gave no longer protection against reinfestation of dipped cattle than did ethion. It allowed a very low level of successful attachment of larvae to occur on the fourth day and a considerably higher level on the sixth day.

Acaricide Application Study

Repeated experiments aimed at improving acaricide application indicated that a hurdle at the dip take-off very materially reduces the number of animals passing through the bath with partially dry heads. But it is not yet possible to guarantee more than about 95 per cent of a herd completely wet at a single dipping.

A spray race previously reported as less efficient than a plunge dip in wetting the whole animals, was found still less effective when used to treat cattle that have thick winter coats of hair.

RESEARCH—BOARD OF TICK CONTROL

Depositing Power of Dip Baths

Hair-dunking tests of all dips in use in the Tick Quarantine Areas were continued. The practice has minimised mortalities from organo-phosphates.

Difficulties in getting suitable supplies of cattle hair led to investigation of use of possible other substitutes but without success.

Stripping Rate and Stability of Dips

Indications that the Border dips might have to be charged with dursban due to the acaricide-resistance problem in Queensland led to two trial dips being charged with this acaricide for observation.

Stirring and settling trials showed that dursban should not present any serious problems under field conditions. But there were indications that the working strength of dursban would need increase to avoid the effect of serious depletion in heavy conditions of dipping.

Toxicity of Acaricides

Observations again indicated that delnav and ethion behave alike as regards toxicity. Keeping the hair depositing power of the dips to a maximum of 4.00 mgm/gm hair minimized losses, although evidence of toxicity was observed in some of the younger animals.

Losses this year, 3.40 per 100,000 head of cattle, were slightly higher than in 1966–67 (2.28 per 100,000). Again ethion appeared to be slightly more toxic than delnav. There was an increase in number of cattle treated for possible organo-phosphate toxicity; in part reflecting the policy change requiring all cattle over the age of one month to be treated during the policy treatments.

At the close of the year the number of dips charged with delnav was 745 and ethion 567.

Further hair and fat samples from cattle suspected of suffering organo-phosphate poisoning were analysed towards ascertaining any relationship between high residues and toxicity. Examination of 200 cases of suspected poisoning from dipping in ethion or delnav indicated that whether an animal had succumbed to organo-phosphate poisoning could be decided fairly reliably in 70 to 80 per cent of cases.

Toxicity of imidan was further investigated. Four groups of calves, sprayed at varied strengths (0.075 per cent, 0.15 per cent, 0.225 per cent, and 0.3 per cent) were compared to the control group and two groups sprayed with 0.075 per cent and 0.3 per cent ethion. Weight gains, whole blood cholinesterase changes, and serum glutamate oxalacetic transaminase (SGOT) levels were used to assess treatment toxicity.

The toxicity of imidan at the recommended strength of 0.075 per cent, as estimated by depression of blood cholinesterase levels, was found to be considerably greater than ethion's toxicity at 0.075 per cent when applied as a spray to calves four to eight weeks of age.

Absence of any rise in SGOT levels was of particular interest. It was in contrast to overseas findings with orally administered coumaphos. Estimation of SGOT levels appeared of little value in diagnosis of organo-phosphate.

Acaricide Studies

Effect of Age of Dip Emulsion.—A series of dursban dip emulsions ranging from 0.010 per cent to 0.050 per cent were made up in the laboratory. After one month these began to crystallize leaving a clear supernatant liquid. The first to crystallize were those ranging from 0.010 per cent to 0.030 per cent whereas those at 0.040 per cent and 0.050 per cent had not crystallized at the end of 3 months. It appeared that this medicament should not be used at less than 0.025 per cent.

Effect of Muddy Sample.—Clean samples were compared with muddy samples at 0.025 per cent, in association with the Cattle Tick Research Station, Wollongbar. The clean samples in this instance held up to full strength for 3 months whilst the muddy sample depleted from 0.025 per cent to 0.018 per cent.

Effect of Stirring.—In this experiment, 37 large animals used for stirring reduced the level of dursban to 0.021 per cent from 0.023 per cent and the dipping of 517 animals caused a further reduction to 0.018 per cent. Seemingly the working strength of dursban needs increase to counter serious depletion under heavy conditions of dipping.

Bromophos-Ethyl.—Trials at the Cattle Tick Research Station, Wollongbar, indicated that nexagan was not as effective as delnav, ethion or dursban against adult ticks. But a single nexagan treatment appeared more effective against nymphs than was a single ethion treatment. This confirmed observations in Queensland that nexagan was quite effective against the larval and nymphal stages but slower in killing engorging adults.

Acaricide Residues in Butterfat

Level of dursban residues in butterfat from the milk of cows dipped once at 0.025 per cent was investigated in co-operation with Wollongbar Agricultural Research Station. It ranged from 1 ppm on the first day after treatment to less than 0.01 ppm 14 days after treatment.

The behaviour was similar to ethion residues, falling to negligible levels within about 14 days. The half-life of dursban in the butterfat was calculated as 49.5 hours, compared to a half-life of 36 hours earlier calculated for ethion.

The work results suggested that no build-up of residues in butterfat would occur during the programme of dipping at 21-day intervals.

Also, further analyses of butter samples from Byron Bay, Lismore, and Kyogle factories were undertaken in respect of ethion, delnav, BHC, DDT, dieldrin and dursban. Twenty-three of the 86 samples for delnav showed residues, ranging 0.02 to 0.32 per cent; 44 of the 86 samples for ethion showed residues, ranging 0.02 to 0.35 per cent; none of the 57 samples for BHC showed residue; 15 of the 57 samples for DDT showed residues, ranging 0.012 to 0.12 per cent; 31 of the 57 samples for dieldrin showed residues, ranging 0.02 to 0.18 per cent; and one of the 39 samples for dursban showed residue (0.02 per cent). As might be expected, the levels of delnav and ethion were lower during winter.

Residues in Meat Products

As indicated in last year's report, the trial started in October, 1966, using the biopsy technique for the collection of fat samples, required analysis of further samples. These analyses have been completed but the samples proved to be too small and no significance could be placed on the results. The trial has pointed the need to improve the biopsy technique, to enable at least one gram of fat to be collected.

The other trial referred to in last year's report was also completed. In this trial three groups received 1, 3, and 6 treatments in 0.066–0.081 per cent ethion and were slaughtered at 1, 4, 8, and 15 days after the final treatment. The objective was determination of the level of ethion, and its persistence, in the subcutaneous and kidney fat of cattle.

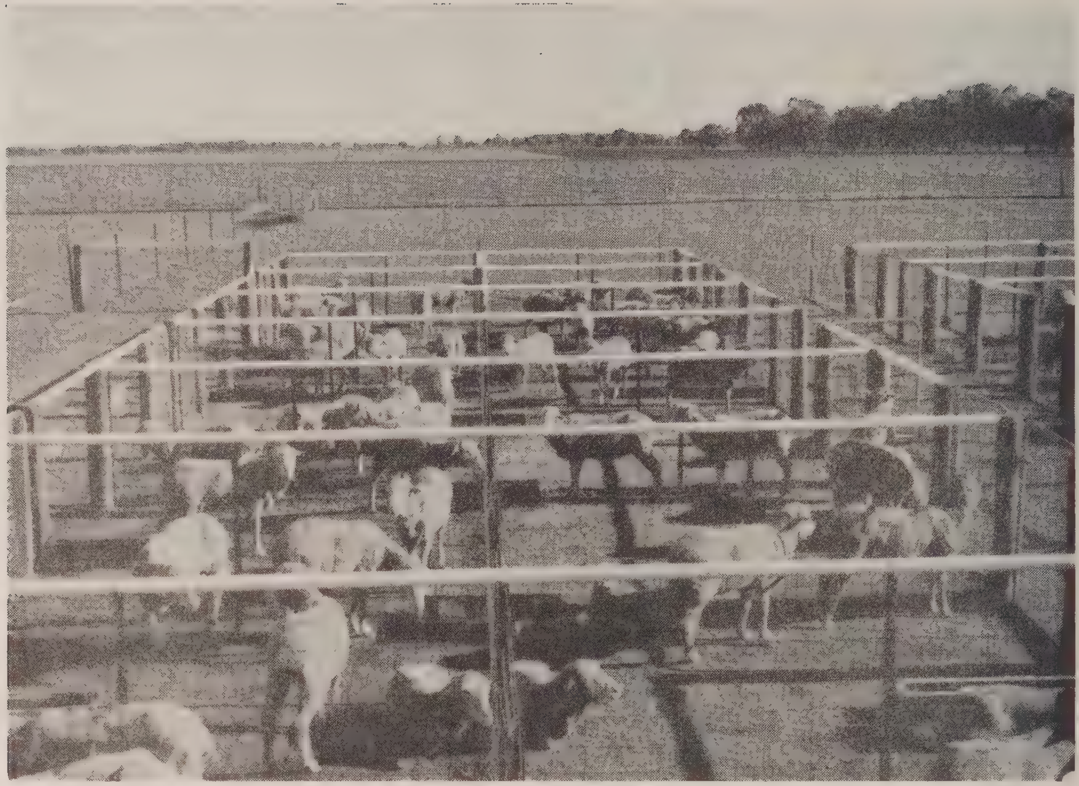
It showed that animals given the six ethion treatments would be unlikely to have tissue residues in excess of 3 ppm. The highest individual figure from the trial was 2.56 ppm from the kidney fat of an animal slaughtered 1 day after the third treatment.

In another trial, at the Cattle Tick Research Station, Wollongbar, cattle received 10 treatments at weekly intervals in ethion 0.075 per cent. They were slaughtered at 1, 8, 15, 22, and 29 days after the final treatment. The results were much the same.

From the trials it has been concluded that residues between 1 and 3 ppm might be expected immediately after three to ten dippings, but that fat tissues have a saturation point around 2 to 3 ppm beyond which the residue does not increase despite further treatment of the animals.

Other trials to determine the residues following the use of dursban were conducted, at the Cattle Tick Research Station. It was satisfactory to note that double strength dursban (0.05 per cent) did not produce residues in excess of 2.68 ppm (mean 2.17 ppm) from six treatments at 4 to 5 days intervals.

From the trials it did not appear that residue levels were likely to be as high as those from 0.075 per cent ethion.



Drought Feeding Research at Trangie

Sheep fed various diets at Trangie Agricultural Research Station gave rise to vital information on feed selection in drought conditions, for survival and wool production.

Investigations into bromophos-ethyl (nexagan) residues in fat of sprayed cattle were also completed. For *Group* 1 there was one treatment with 0.05 per cent, and for *Group* 2 three treatments with 0.05 per cent bromophos-ethyl. At the first day post-treatment the *Group* 1 residues were 0.08 to 2.9 ppm and the *Group* 2 residues 0.3 to 2.6 ppm. At the fourth day the respective range was 0.1 to 2.0 and 0.1 to 1.6 ppm. At the eighth day the respective range was nil to 0.7 and nil to 0.6 ppm.

Another organo-phosphorus insecticide, imidan, did not present any residue problems used as a spray. Indications were that it had a half-life of two days.

In addition to these trials, fat samples were again collected from abattoirs within the Tick Quarantine Areas and analyzed. The detailed results have been appropriately recorded.

Livestock Production Research

SHEEP RESEARCH—TRANGIE AGRICULTURAL RESEARCH STATION

Selective Breeding of Merino Sheep

Response to selection continued in most of the single character selection flocks. However, response in the flock selected for high clean fleece weight ("Fleece Plus") appears to have ceased. Also, there has been no response to selection for a high degree of face cover in the "Face Cover Plus" flock.

Fleece weights in the flock selected for a high degree of skin wrinkle ("Folds Plus") were lower than in the unselected Control flock, indicating the ineffectiveness of this method in increasing wool production.

The commercial demonstration flock selected for wool production ("Nucleus") was 17 per cent above the unselected Control flock in clean fleece weight. Similarly, the commercial flock selected for both fertility and wool production ("Fertility") was 23 per cent above the Control. Both flocks showed such desirable characteristics as low degrees of skin fold and face cover and high body weight.

Of the South Australian strains, the Collinsville increased to 30 per cent its advantage in fleece weight over the Control flock. Both the Collinsville and Bungaree flocks showed the attributes characteristic to the strains: high body weight, low crimp number, and low levels of fold and face cover.

Selection for Skin Fold

Despite higher selection differentials in the flock selected for high skin fold ("Folds Plus"), the realized heritability of skin fold was higher in the flock selected for low degree of fold ("Folds Minus"). When measured as the divergence of the two flocks, the realized heritability results for skin fold (0.44 in the rams, and 0.51 in the ewes) agree well with estimated values.

Selection for Fleece Weight

Linear response to selection occurred in the flock selected for low clean fleece weight ("Fleece Minus") where the realized heritability of clean fleece weight was 0.44 in the first generation and 0.38 in the subsequent three generations. In contrast, responses in the flock selected for high clean fleece weight ("Fleece Plus") ceased after the first generation. In this case, the realized heritability was 0.51 in the first generation and 0.10 in the next generation. Also, heritability estimated by dam offspring regression of sheep born in the flocks after the first generation were 0.50 for the "Fleece Minus", and 0.04 in the "Fleece Plus" flock.

Influence of Selection on Fertility

Direct selection for fertility is practised in the "Fertility" and "Nucleus" flocks and to date has only involved the culling of all ewes which fail to rear a lamb. The lambing and weaning percentages for both flocks were again above the Random flock.

In the flocks selected for and against face cover, weaning weight, crimp number, and fleece weight there has been no discernible change in fertility. However, the "Folds Plus" flock has continued to show substantially poorer reproductive performance than the "Folds Minus" flock.

The reproductive performance of the Bundemar, Wonga and Collinsville flocks has again been very high although, as with all flocks, it was not quite as high as in 1966.

Efficiency of Wool Production

Ewes from the "Folds Plus", "Folds Minus", and selection flocks, and the Control, were used in a wool efficiency feeding trial.

The "Folds Plus" and "Folds Minus" ewes differed by about 10 per cent in clean fleece weight. No difference in body weight change between these selection flocks was observed at any of the nutritional levels. If "Folds Plus" sheep produce slightly more wool and maintain their body weight in relation to "Folds Minus" they therefore must be slightly more efficient.

Comparison of Lambing Management Systems

This project compared the ewe and lamb mortality of flocks lambed under a "drift" system given considerable supervision with that of a flock given no supervision. Management of the unsupervised flock was altered by dividing the mob in three on lambing date and bringing each to the yards only once for mothering, marking and mulesing. Previously there was only one large mob and this was yarded twice during lambing.

Compared with previous years there was a much smaller difference in lamb mortality between the two systems. The mortalities for drift and unsupervised groups were respectively 11.2 per cent and 13.0 per cent in 1967 compared with 13.0 per cent and 22.7 per cent in 1964–66. Three ewes (1.5 per cent) died in the unsupervised system whereas no ewes died in the drift system.

The pattern of and causes of lamb mortality were similar to previous years except that the mortality of twins was lower than that for singles (9.9 *vs* 13.4 per cent).

Comparison of Seasonal Variation in Fertility of Bungaree and Peppin Ewes and Rams

Experimental evidence from previous years indicated that the high percentage of dry ewes in the flock of Bungaree ewes at the Trangie Agricultural Research Station was due to a low fertilization rate of ova independent of the strain of ram used. Experiments were conducted in March-April, 1968, to examine sperm transport and fertilization rate in Bungaree and Peppin ewes joined to Bungaree rams.

These experiments indicated poor sperm transport in Bungaree ewes during the first fortnight of joining and an improvement to normal levels in the following days. A group of Bungaree ewes which had been grazed with vasectomised rams for 3 weeks showed a normal fertilization rate, indicating that the improvement in sperm transport was related to an improvement in fertilization rate, probably due to the association with rams.

The group of Bungaree ewes which had been used in these experiments was then joined to fertile rams for 22 days. Lambing performance of these ewes will add to the information obtained.

Productivity of Natural Annual Pastures and Lucerne

Natural Pastures Stocking Rate Trial.—This trial was designed to investigate the management and sheep carrying capacity of natural annual pastures supplemented with lucerne or natural perennial pasture.

Results from the first 7 months of the experiment indicated that in the natural perennial areas *Chloris* sp. can germinate and become established under a stocking rate of 1½ wethers/acre. Two wethers/acre ate the pasture well down and prevented germination and establishment.

There was a decline in lucerne plant numbers, probably due to the very low rainfall and the need to move more sheep onto lucerne areas.

Wether body weights showed that during the dry summer period those on the lucerne pasture were slightly heavier. Those on natural pasture had a slight advantage due to recovery after January rains.

Lucerne Grazing Trials.—The pilot trial, with 40 ewes rotationally grazing 10 one-acre paddocks of lucerne, finished its third year. Due to drought conditions, the ewes received supplementary feed for 6 months. Plant density declined markedly to below the level of May, 1965, when the trial started.

In the large scale comparison of set-stocking and rotational grazing, the two set-stocked treatments were terminated. All lucerne plants were dead after 7 months of set-stocking at five sheep/acre and after 12 months at two sheep/acre. At the end of the first year, sheep body weights and wool production were not significantly different (60 lb/acre). There was a significant 17 per cent decline in plant density in the four paddock rotation with a 12 day grazing period, compared with the 6 per cent decline in the eight paddock rotation with a five day move.

Lifetime Performance of Single and Twin Born Merino Ewes

Seven properties co-operated in this project. It involved the identification of singles and twins at birth and the measurement of their subsequent performance when run under the same conditions.

On the two properties where animals reached the age of 2½ years, singles still had a slight advantage in wool production but there was no difference in reproductive performance. In the more recently commenced replicates the pattern of the earlier results was repeated.

Large differences in bodyweight and dimensions at marking and weaning became small and non-significant by 12 or 18 months. Singles in all cases produced significantly more wool in their first year.

Field Studies on Ram Fertility

Experiments on five properties compared the fertility of rams with different degrees of skin fold and/or the fertility of rams when mated in the ratios of 1 or 3 per cent.

On three properties where "Folds Plus" and "Folds Minus" rams were compared, no significant difference in fertility was detected. On four properties where the mating of rams in the ratios of 1 or 3 per cent were compared there were slight depressions in fertility in the 1 per cent groups in all cases, but this was significant on only one property and then only in the "Folds Minus" 1 per cent group and not in the "Folds Plus" 1 per cent.

Dominant Lustre Mutant Fleece Types

The lustre mutant is a dominant gene affecting the fleece of Merino sheep. Although a dominant gene, lustre and normal matings have been given a segregation ratio which differs significantly from the 1:1 expected. The ratio observed is 1.2 normals : 1 lustre.

The lustre gene was found to decrease birthweight by 10 to 15 per cent, and increase lamb mortality especially before or during birth. The gene decreased fleece weight by reducing primary and secondary follicle density, and by reducing fibre length. Lustre animals had poorer jaws, less skin fold, and a greater expression of horns among the ewes than do normal Merinos.

In 1967, lustre heterozygous rams and ewes were mated. In all, 135 lustre and 41 normal lambs were born; a result close to the 3:1 ratio expected. However, due to higher lustre lamb deaths, the numbers at weaning were 48 lustres and 28 normals.

Supplementary Feeding of Sheep for Increased Wool Growth

The wool growth response of Collinsville, Bungaree and Peppin Merino ewes when fed cottonseed or peanut meal with wheat or oats was studied. Diets were fed at the level of five units of starch equivalent per head per week.

Oat-based diets gave better wool growth than wheat-based diets. When wool growth on all diets was compared to that on the wheat diet, the oats and 25 per cent cottonseed meal gave a 56 per cent increase. Peanut meal with oats gave a smaller response (42 per cent); probably due to its higher solubility in the rumen and loss of some protein nitrogen as ammonia.

SHEEP RESEARCH—CONDOBOLIN AGRICULUTRAL RESEARCH STATION

Comparison of the Peppin and South Australian Merino, Crossed with the Border Leicester

Bungaree ewes cut 30 per cent more clean wool than comparable Peppin ewes, averaged over five seasons of wool growth. These ewes also weaned more lambs; 80 per cent for the Bungaree ewes compared with 60 per cent for the Peppin ewes at their final mating beginning November, 1967.

Despite the heavier birth weights of Border Leicester-Bungaree lambs from this mating, there was negligible difference in carcass weight between Border Leicester-Bungaree and Border Leicester-Peppin wether lambs.

Border Leicester-Bungaree ewes cut 12 per cent more clean wool than Border Leicester-Peppin ewes. The Border Leicester-Peppin ewes weaned more lambs than Border Leicester-Bungaree ewes from the spring 1966 mating. Previous results have indicated that second-cross lambs have similar growth rates and carcass measurements between groups.

Border Leicester Improvement

Two hundred and fifty-eight half-bred and one hundred and seventy 19 months old B75 ewes (75 per cent Border Leicester, 25 per cent Merino) were joined in 1967 to twin or triplet-born Border Leicester rams. The lambing result for the two groups were, respectively: 91 and 92 per cent wet ewes, 78 and 62 per cent multiple births, 171 and 155 per cent lambs born and 155 and 140 lambs weaned.

The effect of post-weaning nutrition was shown to influence mating and lambing performance of B75 ewes when joined at seven months of age. The percentage, respectively, of ewes mating and of lambs born (in three nutritional treatment groups: High, Medium and Low) was 84, 55 and 32 per cent, and 61, 42 and 26 per cent.

*Native Pasture Grazing Trial**

This trial was designed to determine the optimum stocking rate of native pastures. The trial started in 1965 with stocking rate treatments of 0.83, 0.55 and 0.43 wethers/acre. Body weights and wool production data indicated that these pastures can carry between 0.55 and 0.83 wethers/acre.

*Jemalong Barrel Medic Grazing Trial**

The carrying capacity of Jemalong barrel medic was investigated, using the three stocking rates 1.25, 1.66 and 2.5 wethers/acre. At the highest stocking ratio, comparison was also made between set stocking, rotational grazing and autumn deferment. Rotational grazing or autumn deferment of the barrel medic had no advantage over set-stocking. The barrel medic made up about 50 per cent of the pasture present, and *Medicago minima* was the next from most important.

*Lucerne Grazing Management Trial**

This trial was commenced in 1966 to investigate the management of dry land lucerne. Comparisons between a 4, 6 and 8 paddock rotation and set stocked treatments were included. Lucerne plants in set stocked treatments were eliminated within nine months. The decline in plant numbers during 1967 necessitated termination of the four-paddock system. During 1967 an eight-paddock system was better able to carry the four wethers/acre.

SHEEP RESEARCH—TEMORA AGRICULTURAL RESEARCH STATION

Breed Comparison Trial

Of the five breeds in the comparison (Corriedale, Polwarth, Peppin Merino, South Australian Merino and the fixed half-bred Border Leicester-Merino (BLM)) the Corriedale hogget ewes again had the highest greasy and clean fleece weights. However, the BLM flock weaned 138 per cent lambs; a result, as in previous years, markedly superior to that of any other breed in the comparison.

The Influence of Rates of Stocking and Superphosphate Application on the Productivity of Merino Ewes Grazing Improved Annual Pasture

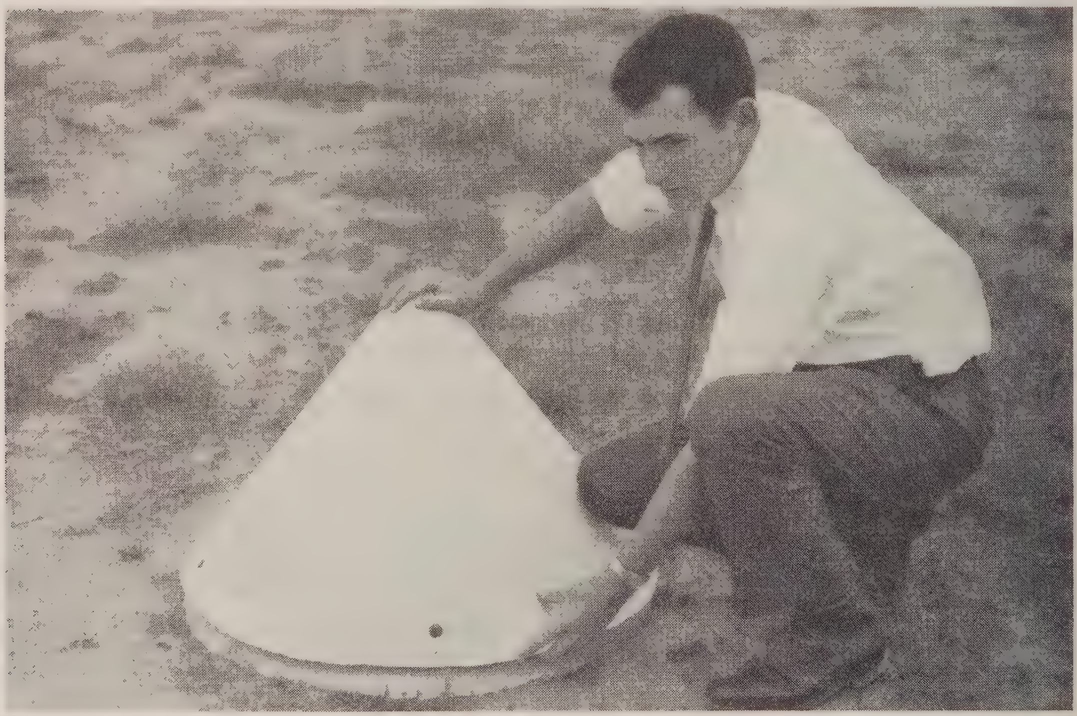
This project was commenced in October, 1966, to investigate influence of three levels of superphosphate application on the stocking rate of a rye grass-subterranean clover pasture.

Rainfall distribution rather than treatment appeared to have governed botanical composition during 1967. The reduced rainfall favoured grasses and weeds rather than clovers. The average wool production per head for each treatment was about 2 lb lower in 1967–68 than in 1966–67. There did not appear to be a significant treatment effect on wool production. This could be expected because of the long periods of hand feeding necessary.

Drought Feeding Experiment

This experiment was to compare the performance of sheep fed either cottonseed alone or a mixture of equal parts of cottonseed and wheat, with sheep fed wheat alone. Corriedale ewes ate an average of 5 oz fuzzy whole cottonseed, per sheep per day, and their mean weight fell about 16 lb in eight weeks. Sheep receiving ½ lb of cottonseed and ½ lb of wheat or 1 lb of wheat/head/day consumed all their ration. There was no significant difference in mean body weight loss.

Elevated glutamate-oxalacetate transaminose levels in blood serum, and hypertrophy of the heart, were observed in sheep receiving the cottonseed-wheat mixture.



Dry Land Lucerne Management Research

Airfield markers adapted to the project prevent light reaching lucerne plants, and allow root reserves to be measured. This is in research on management of dry-land lucerne sheep-grazing

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* Co-operative trial with Division of Plant Industry.

SHEEP RESEARCH—COWRA AGRICULTURAL RESEARCH STATION

Hybrid Vigour in Lamb Production

Averaged over 5 years, lamb survival for Border Leicester-Merino crossbreds was 79.4 per cent as opposed to a mean of 69.3 per cent for the two pure-breds. There was also considerable hybrid vigour for growth and carcass characters of the 1967 drop lambs, and for fleece weight in the 1966 drop ewes.

Lambs weaned in 1967, was 63 and 112 per cent for the pure-bred and cross-bred maiden ewes, respectively, and 82 and 131 for the corresponding mature ewes. The crossbreds were superior for all components of reproductive performance, percentages of ewes mated, wet ewes, multiple births and lamb survival.

Grazing Systems for Lamb Production

This project was started in 1966, to investigate grazing management systems of a lucerne/rye grass/subterranean clover pasture. Lucerne was eliminated from the set-stocked treatments. Set-stocking of the rotational treatments from lambing till weaning also damaged the lucerne component. But there were indications that set-stocking was more favourable for lamb growth.

There appeared to be no effect of management treatment on ewe bodyweight.

SHEEP RESEARCH—COWRA AND GLEN INNES RESEARCH STATIONS

Crossbreeding in Prime Lamb Production

In the first phase of this trial, Merino, Border Leicester and Dorset Horn rams were joined with Merino ewes in 1964 and 1965 and their progeny compared. In general, for both years and sites, the Dorset x Merino wether lambs grew slightly more rapidly than did the Border Leicester-Merinos. When the ewe progeny were shorn as hoggets, the Border Leicester x Merino ewes had the highest clean-fleece weights.

Lambs weaned for the Merino, Border x Merino and Dorset x Merino ewes were 50, 34 and 58 per cent, respectively, when joined in the spring, and 62, 111 and 114 per cent when joined in the autumn.

SHEEP RESEARCH—LEETON AGRICULTURAL RESEARCH STATION

Autumn-Winter Nutrition of Breeding Ewes on Irrigation

Production of autumn lambing ewes stocked at 4, 6, 8 to the acre is being compared under different pasture management systems on irrigation. The basic farmlet is of subterranean clover and wimmera ryegrass pasture. The value of ⅛ and ¼ of the farmlet area as summer pasture (paspalum/white clover) and/or sod-sown oats is being evaluated. The resultant design is a 3 x 3 x 3 factorial containing 27 groups of six ewes.

Stocking rate: 4, 6, 8 ewes

Summer pasture: 0, ⅛, ¼ of farmlet area

Sod-sown oats: 0, ⅛, ¼ of farmlet area

The first year's results indicate that 4 ewes/acre can be safely set stocked on subterranean clover and rye grass alone, but that 8 sheep/acre is too heavy a stocking rate for the production of prime lambs.

Use of summer pasture and oats had little effect on lamb growth rate in this first year, although the pattern of ewe bodyweight changes throughout the year was affected.

Controlled Breeding of Ewes Using Progestagen

A series of trials were done in the 1966 spring to evaluate use of progestagen-impregnated sponges inserted intravaginally to control breeding of anoestrous Border Leicester x Merino ewes for prime lamb production. Results showed inconsistent responses to the technique, and most of them uneconomic.

In the 1967 autumn a second series of trials investigated the use of these sponges and pregnant mare's serum to augment the fertility of autumn-joined Border Leicester x Merino ewes. The results again showed economic loss because of failure to get sufficient increase in lamb numbers to offset the treatment cost.

Application of the Egg Transfer Technique to Sheep Breeding

A group of Merino ewes was selected as donors to provide fertilized ova for Border Leicester x Merino recipients. The oestrous cycles of both groups were effectively synchronized using intravaginal progestagen pessaries, with mating delayed till the second cycle after pessary withdrawal.

Fertility appeared to be normal for the crossbred recipients. The average number of ova shed by the superovulated donors was 8.0 and was less than expected. Of these only 52 per cent were recovered. Lambing data were not available at 30th June, 1968.

Ewes Other Than Border Leicester x Merino for Early Breeding of Prime Lambs

A flock of 54 Dorset Horn x Merino maiden ewes was joined in early October. Most of the ewes were pregnant within 4 weeks. The lambing percentage of 141 and marking percentage of 108 were excellent for spring-joined maiden ewes. Fifty per cent of the ewes had multiples.

There will be further work in the 1968 spring on this promising crossbred ewe.

SHEEP RESEARCH—YANCO AGRICULTURAL RESEARCH STATION

Cheviot—Merino Comparison Trial

The ewes from the first phase of this trial (Merino, Cheviot-Merino and Border Leicester-Merino crossbred ewes) were mated in both autumn and spring. The reproductive performance of the Border Leicester-Merino cross, to the autumn joining was particularly good, mainly because of a high proportion of twins. Both the fleece weight and lamb growth were greatest for ewes from this cross.

SHEEP RESEARCH—FACILITIES PROVIDED BY CSIRO, PROSPECT

Ram Importance in Flock Reproductive Performance

There are two major themes in this project. One aims at isolating a field method to accurately assess the fertility status of a ram at any time. There is hope but no guarantee of success in that. Therefore, the second theme has been launched. This aims at defining the various field conditions that produce heat infertility in rams.

Studies in 1967–68 on the association between corrected heat load and fertility were conducted in association with the first aim of this project. Controlled infertility, using heat, would accelerate progress of the search for a method to assess ram fertility accurately. Results in 1967–68 were disappointing.

Much success was derived in the second aspect of the project, when the first stage of a telemetry system was used to measure subcutaneous scrotal temperatures of freely grazing rams. By extending the use of this method it will be possible to define the various heat loads that rams experience in the field. The effect of these heat loads on fertility can then be measured in the laboratory.

SHEEP RESEARCH—TAMWORTH AGRICULTURAL RESEARCH STATION

Dorset Horn vs Border Leicester x Merino Ram

The 1967 joining in this trial compared the prime lamb progeny of heavy, medium and light sires of each breed. Rams of each breed were born as singles in the same lamb drop, were selected on the basis of 17 months body weight and mated at 19 months of age.

Carcass weights of lambs sired by Dorset Horn rams were again heavier (7 per cent) than those sired by Border Leicester x Merino rams. In contrast to the results of the previous joining the progeny of heavy sires were significantly heavier (5 per cent) than those of light sires.

Evaluation of Dry Land Grazing Lucerne

This trial is designed to study the relationship between stocking rate and productivity of dry sheep grazing lucerne in the Tamworth environment. There are five stocking rates, with 15 Border X Merino dry sheep per flock. Each of these flocks rotationally grazes six paddocks, with hay cutting where feed is excess.

In the first year, the highest stocking rate (8.7/acre) had to be fed more hay than was actually cut from its area and the next from highest (7.3/acre) had to be hand-fed for 11 weeks. The stocking rate of 6.0 sheep/acre only required six weeks of hand-feeding and had a surplus of 1,300 lb of hay/acre.

SHEEP RESEARCH—SHANNON VALE NUTRITION STATION

Performance of Poor and Improved Merino Strains under High and Moderate Stocking Rates

In this experiment, 105 breeding ewes from Trangie flocks selected for high and low wool production ("Fleece Plus" and "Fleece Minus" respectively) are run at two stocking rates: two and six ewes/acre. In 1967, there were significant differences in favour of the lower stocking rate for both the percentages of lambs born and weaned, and for the weaning weights of the lambs. However, six breeding ewes/acre produced 48.8 lb of greasy wool compared to 22.1 lb from the two ewes/acre.

"Fleece Plus" ewes weaned significantly more lambs than did the "Fleece Minus" (87 per cent *vs* 78 per cent). The advantage in wool production of the "Fleece Plus" ewes declined from 40 per cent at two ewes/acre, to 30 per cent at six ewes/acre.

Production from Different Rates of Superphosphate at Different Stocking Levels

This experiment involved nine flocks of wethers, each set-stocked at a superphosphate x stocking rate treatment. Superphosphate levels of ½, 1½ and 3 cwt/acre and stocking rates of 4, 8 and 12 wethers/acre were used. There was no significant difference between superphosphate levels and no significant superphosphate x stocking rate interaction.

The results suggested possible other nutritional deficiencies. Response to a number of major and minor elements is being examined in the experimental areas.

BEEF CATTLE RESEARCH

Improvement of Breeding Stock

Analysis of records from over 3,000 calves in one herd has shown:

(i) That up to 69 per cent of the variation in weaning weight was due to the environmental effects. The use of records in an effective selection programme depends on minimizing these environmental effects by adjusting for those which can be measured accurately.

(ii) For weaning weight the age and sex of calf and the age of its dam are the important factors for which adjustment should be made. The adjustments are of the same order as those previously published from earlier studies in this herd.

(iii) A record of birth weight is not necessary to the implementation of an effective improvement programme.

(iv) Weaning grade, as subjectively scored, was only slightly affected by sex, age of dam, and age of calf. It is interesting but not surprising that weaning grade was influenced by weaning weight and condition score. Each of these factors accounted for about 15 per cent of the variation.

(v) Differences due to breed were unimportant in any of the traits studied.

(vi) Heritability of weaning weight has been found to be 0.18 ± 0.05.

The system of performance-recording in the Angus stud herd at Trangie Agricultural Research Station aims to make more effective the selection of breeding stock. This is combined with a breeding programme designed to give increased genetic progress for economically important traits.

The data being collected in this herd will enable a clearer definition of important production traits, and methods of measuring these. Valuable information on the possibilities and problems of including measured production in a breeding programme will be provided. From this, more efficient breeding plans can be designed.

Observations on reproductive functions in this herd continued.

POULTRY RESEARCH—POULTRY RESEARCH STATION, SEVEN HILLS

Breeding Project (Eggs)

The current egg breeding programme was started in late 1959 when the reciprocal recurrent selection programme for egg production was ended. It includes three egg production flocks and three corresponding control flocks; Australorps, White Leghorns and Synthetics (the latter a closed population based on both crosses between White Leghorns and Australorps).

Between 2,000 and 2,300 pullets are tested in single-bird cages each year. Selection is carried out on September-hatched chickens, by egg production to the end of June. Use of the Public Service computer has facilitated the breeding selections. The ninth generation was hatched in September, 1967.

The selection last year was made by using an index dependent upon number of eggs laid by the bird, and by its full and half sisters, and the weight and shell quality of a sample of its eggs.

In the last year a gain average of 5.30 eggs/generation was made, and over the past three years the gain average has been 8.41 eggs/generation.

Broiler Breeding Programme

The seventh selected generation of the broiler breeding programme was hatched during November and December, 1967. A randomly selected control flock mating was carried out at the time of the selected breeder matings. Two flocks are maintained, an E and a D flock. The E flock is the more advanced line. The D flock will be used later on, as the female line.

Selections each year have been for weight at 9 weeks, and white feathering. The birds are scored at 10 days of age for type of feathering, whether rapid or slow. But selection for this trait has not yet been exercised. It can be quickly brought in whilst rapid and slow feathering are segregating in the flock.

The programme was originally to provide broiler birds for the industry but since this need has been adequately met by commercial breeders, the programme is providing birds for associated genetic investigations.

Progress until this year has been pleasing. It indicated that additive genetic variance was responsible for much of the variance for growth weight in the two flocks. This year's low gain may have been due either to a biassed control flock (selections are at random and the flock is not large) or a plateau.

The Genetic Correlation of Broiler Feed Conversion and Growth Rate

The past assumption has been that faster growing birds are the more efficient producers of meat. But a recent overseas investigation indicated that a broiler line selected for rapid growth rate had a poorer feed conversion when fed *ad lib*, than a line selected for low growth rate. In the line selected for increased growth rate, the appetite of the chicken appeared to far outstrip requirements.

A single-chick cage unit for 240 birds was constructed, for measuring individual feed consumption. The unit is in an air-conditioned room at 75° F. Chickens are placed in the cages at eight days and removed at 29 days of age. The first selected generation was based on 15 sire families, each with four dam families; each with two male and two female progeny (15 x 4 x 2 x 2 = 240).

Selections were made for feed efficiency and three lines were established, viz.: high efficiency, low efficiency; and a randomly selected control population. Analysis of data has not been completed.

Correlations between Egg Weight and Subsequent Broiler Performance as Influenced by Age of Dam

Phenotypic correlations between egg weight, day-old weight, 5-week weight and 9-week weight were obtained for two broiler chicken flocks of different ages but similar genetic constitution.

Correlations between egg weight and body weight were very high at hatching and decreased with the age of the chickens, but were still significant in males at 9 weeks. Day-old chick weight correlations with 5 and 9 weeks' weight were slightly higher than the egg weight correlations. Correlations for males were consistently higher than those for females. Correlations between any two traits were similar in both flocks.

Feeding Value of Low Grade Wheat

A series of experiments between 1965 and 1967 indicated that the nutritional value of the protein of high protein wheat (18 to 19 per cent) is inferior to that of lower protein wheat (11 to 13 per cent).

Effects of supplementary lysine, arginine and methionine have now been examined by short-term chick-growth assays.

Arginine and methionine supplements decreased the growth and the feed utilization efficiency of chicks given low protein wheat. Lysine supplements (up to 0.50 per cent additional lysine) increased growth rate.

The growth and the feed utilization efficiency of chicks given high protein wheat was however increased by arginine, methionine or lysine supplements. And the effects of supplementary arginine and lysine were additive.

High protein wheat therefore appears to be deficient in lysine, arginine and methionine. The lysine content of low protein wheat appears to be limiting, and may affect the response to other amino acid supplements.

High and Low Protein Wheat for Layers

Because high protein wheat was found to depress the growth of broiler chickens, an experiment was conducted to determine whether the nutritional value of high protein wheat for laying hens was equivalent to that of low protein wheat.

Wheats of 11 per cent and 17 per cent protein were compared in diets containing meatmeal, meat and bone meal, lucerne meal, limestone, salt and a vitamin premix. Each diet was given to groups of hens in cages. Egg production, feed consumption and egg quality were recorded. Analysis of the results has not been completed.

Choline in Poultry Diets

An experiment in 1967 showed that broiler chickens given diets containing 800 mg supplementary choline chloride per lb (basal level 500 mg/lb) for six weeks, grew more rapidly than those given lesser amounts of choline. But at seven to eight weeks of age as little as 400 mg supplementary choline chloride/lb brought on toxic symptoms. These could be reversed by choline withdrawal or large amounts of pyridoxine given by mouth.

Since these observations had not been previously repeated the experiment was set up again in 1967–68. No deleterious effects of choline supplements were observed. and the choline requirement could not be adequately assessed.

Meatmeal Investigations

Evaluation of 12 routine laboratory assays as means of estimating nutritional value of meatmeal was completed, on 20 different samples. Chick-growth assays indicated that variations in the laboratory analysis of the samples could not account for more than about 20 per cent of the variation in nutritional value of the meatmeals sampled.

Detailed analyses of the correlations (for the 20 samples) between weight gain and feed intake, weight grain and calcium content, and feed intake and calcium content, showed that the major growth determinant is the amount of the diet consumed; and suggest that the nutritional value of a meatmeal is associated with its individual effect on *ad lib* feed intake.

The calcium content of the diet had little effect on the relationship between feed intake and subsequent weight gain, and the influence of calcium *per se* on weight gain disappeared when intake was held constant.

There is need now to investigate the factors influencing the *ad lib* intake of different meatmeal samples.

High and Low Protein Sorghum in Laying Diets

Three diets based on either high or low protein sorghum were compared with a wheat-based diet. From a consideration of hen day production, hen housed production and feed efficiency, the birds on the diets based on wheat produced more than those on sorghum diets.

When the protein content of the diet based on low protein sorghum was raised by protein supplements to the level of the wheat-based diet, production approached that of the birds on wheat diets. But when the protein level of the sorghum diet was increased to a similar level by the use of high protein sorghum, production did not increase.

This indicated that the amino acid balance in the high protein sorghum was not suitable for production.

Survey of Trace Elements in Australian Poultry Feedstuffs

The proximate composition and trace element content of 196 samples of 20 local feedstuffs were surveyed in collaboration with Division of Science Services. Large variations between samples of a given feed (in protein, moisture, fat, ash, and trace elements) were observed.

This emphasized the need to consider not only mean values but also the possible range when the data are used for feed formulation. Differences found between the composition of local and overseas feedstuffs showed the need for continuous examination of local materials.

Riboflavin in Laying Diets

The riboflavin requirement of crossbred layers in cages and on deep litter has been re-evaluated. The data currently used for feed formulation are based on experiments, with pure breeds on deep litter, which indicated that 1.0 mg riboflavin/lb diet is sufficient for optimum performance.

Studies of effects (on egg production and the efficiency of feed utilization) of stepwise addition of riboflavin to the diet revealed that crossbreds *in deep litter* pens require between 1.5 and 2.0 mg riboflavin/lb diet for optimum performance. But 1.5 mg riboflavin/lb diet appears to be enough for crossbreds *in cages.*

These results indicated the need for continued re-appraisal of the nutrient needs of poultry.

Controlled Lighting of Growing and Laying Pullets

Growing Period.—A step-down lighting regime using weekly increments of 25 minutes produced a delay of five days in sexual maturity, as measured by the achievement of 50 per cent production. This difference was statistically significant but was less than would have been expected. There was no significant difference in early egg size.

A second trial suggested that providing a step-down programme with morning light only, *versus* morning and evening light, or using different stocking densities, has no effect on age at sexual maturity or initial egg size.

Laying.—At about 20 per cent production, the birds (reported in previous paragraph) were transferred to laying cages, such that laying records for rearing treatments could be maintained. For the first two months in lay the production means (hen day basis) for the birds under supplementary electric light were significantly ($P < 0.05$) superior to those under the natural regime (65.0 per cent *vs* 45.3 per cent).

Growth and Feed Efficiency Effect of Stocking Rate of Australian White Turkeys to 24 Weeks

From Hatching to Eight Weeks.—Under the conditions of the experiment the indication was that it would be inadvisable to stock males at a density higher than 1.0 sq ft per bird, and females higher than 0.6 sq ft per bird.

From Eight to 24 Weeks.—The efficiency of meat production for five stocking densities was estimatcd per bird started at 8 weeks of age, and on a pen basis, assuming fixed feed and meat prices.

The growth response per bird started at 8 weeks showed over the first 8 weeks for male a slight positive response to floor space: birds at 4 and 5 sq ft rates were statistically superior to those at 1, 2 and 3 sq ft bird. The females gave the same response except for a low value for return at the lowest stocking density.

For both sexes, from 8 to 24 weeks there was a well marked positive response of return with floor space; the males were displaced about 40c above the females.

In terms of meat production per pen (100 sq ft floor space) the results in general were the reverse of the foregoing (per bird) because the greater amount of meat produced per pen at the higher densities more than offset any greater loss incurred by mortality or poorer growth.

Pellets vs *Mash for Turkeys from 12 to 20 weeks of age*

Male white turkey poults gained slightly more weight over the period and had better feed conversion ($P < 0.05$) when fed a 21 per cent protein diet in pellet form. On the other hand, for the females that were run with the males the reverse was true. For the mixed groups, pellets gave the better feed conversion ratios.

DAIRY CATTLE RESEARCH—WOLLONGBAR AGRICULTURAL RESEARCH STATION

Spring vs *Summer Calved Cows Grazing Tropical Legume-based Pastures*

Production from Glycine javanica/Vetch Pastures.—This part of the project has been run on two farmlets, each of 14 acres. Ten summer-calved cows (late November to early January), grazed on one farmlet, and ten spring-calved cows (July-August) grazed on the other farmlet, on a year-round basis.

The total area of each farmlet was sown to Clarence Glycine in 1962–63 or 1963–64, and was topdressed annually with 3 cwt molybdenum-superphosphate-potash/acre. Approximately 15 per cent of the total area has been annually sown to golden tares in autumn. The sowing time has been adjusted to provide late feed for the summer-calved group and early feed for the spring-calved group.

There was virtually no difference in butterfat production between calving systems for either the 1965–66 or the 1966–67 lactations. However, the lactation curves were quite different. That of the summer-calved cows reached a higher early peak but fell below that of spring-calved cows in the later stages of lactation.

Yields in the 1967–68 lactation were higher for the spring-calved group. But the summer-calved group was no different to the previous lactation at this stage, with (at 30th June, 1968) 4½ months of the lactation to be completed.

Production from Tropical Legume/Grass Pasture, with Fertilizer Nitrogen.—Ten spring and ten summer calved cows, each grazed on one of two farmlets (of about 14 acres) on a year-round basis. Each farmlet was sown to Silverleaf Desmodium (70 per cent of the total area) and Clarence Glycine (30 per cent) in 1964 or 1965.

As with the Glycine/Vetch pasture, a maintenance fertilizer of 3 cwt molybdenum-superphosphate-potash/acre was applied annually.

About half of the area of each farmlet was topdressed with 100 lb nitrogen/acre/annum, in the form of sulphate of ammonia. In the case of spring calved cows the nitrogen fertilizer was applied in September, and for the summer calved cows was applied in late March-early April.

Again, there is little difference between the spring calved and summer calved cows. The use of nitrogen fertilizer apparently further increased production relative to that achieved on the "all legume" system.

Milk Yield from Nitrogen Topdressed Grass Pasture

This experiment, started in 1965, had previously shown that on a predominantly kikuyu grass sward annually topdressed with 300 lb nitrogen/acre the butterfat production increased per acre but decreased per cow as stocking rate increased to 1⅓ cows/acre.

At the completion of the second lactation in 1967 it was decided that the potential carrying capacity of this type of pasture had been underestimated. The experiment was modified accordingly and repeated with (a) 2 cows/acre, plus an energy supplement; (b) 2 cows/acre; (c) 1⅓ cows/acre; and (d) 1 cow/acre.

The supplemented group of cows received 6 lb of crushed oats/cow/day. The object of this supplement is to "carry" high stocking rate cows through the dry spring and early summer. No supplement was fed after late December.

Per cow production decreased and per acre production increased, with increased stocking rate. The supplementary feeding of the high stocking rate group significantly increased production per acre and per cow.

Feed Year Production Trial

Two pastures have been used in this long-term trial; 24 acres devoted entirely to *Glycine javanica* and kikuyu grass, and 24 acres of unimproved land.

Eighteen cows have been carried on the glycine/kikuyu pasture and ten on the unimproved land. Half of the 18 cows grazing the glycine/kikuyu pasture have received 4 lb of oats daily if they produced 20 lb of 4 per cent fat corrected milk (FCM). Below this level they have received no concentrate. Heifers received 4 lb of concentrate at a minimum production of 15 lb of 4 per cent FCM.

The cows on the unimproved pasture calved in spring, and those on the glycine/kikuyu pasture in summer.

Butterfat production by the cows receiving concentrates was significantly raised in comparison with the two unsupplemented pasture groups. Production of the latter two were on a par with each other.

PIG RESEARCH—WOLLONGBAR AGRICULTURAL RESEARCH STATION

Carcass Studies

(a) The weights of six individual muscles and total muscle from both sides of commercial carcasses were examined in female and castrate male pigs slaughtered at 70, 100 and 130 lb. No significant effects (on muscle weights) of side, side by sex interactions, or side by slaughter weight interactions, were found. The studies suggested that carcass muscle studies can be restricted to dissection of only one side.

(b) The effects of weight at slaughter, and variation in the plane of nutrition, on the weights of six individual hind-quarter muscles, and their relationship with total muscle weight, were determined. So, too, were the effects of littermate block and sex.

Expressed as a percentage of total muscle weight, *m. semimembranosus* decreased significantly as slaughter weight increased from 30 to 160 lb liveweight. As a group, the six muscles formed a constant percentage of total muscle. Individual muscle weights were significantly affected by variation in the plane of nutrition during growth from 40 to 160 lb liveweight.

The differences found in muscle weight distribution were probably of little economic importance but may be important sources of error in equations that predict total muscle weight from the weight of individual muscles.

Milk/Wheat Feeding Trial

(a) Response surfaces were examined: relating inputs of separated milk and wheat to liveweight gain, efficiency of feed conversion, and carcass composition, of pigs growing to pork or bacon weights. Twenty-eight different dietary treatments were examined, in eight experiments.

Diets ranged from all separated milk to all wheat. In each experiment, levels of feeding ranged from two to five per cent of live weight. In all, 128 individually fed pigs were used.

As levels of feeding increased: daily gains increased, dissectible lean decreased, but there was no consistent effect on efficiency of feed conversion. The exception was where the quality and quantity of protein ingested limited the growth rate. In these circumstances feed efficiency deteriorated. Desirable factors were not necessarily associated with any one treatment.

Although high daily gains meant that pigs were marketed earlier, carcasses produced in this way were fat and not as valuable as those from pigs grown more slowly.

(b) Using low, medium, and high feeding levels: three growth patterns were designed to produce pigs of 160 lb liveweight at about the same age.

Daily liveweight gains closely followed level of feeding. Pigs on the low feeding level required more feed per lb liveweight gain than those fed at higher levels. The overall efficiency of pigs fed a high-low pattern was less than that of pigs fed medium-medium or low-high patterns.

Although the low-high pigs had significantly more fat than pigs on other treatments, mean carcass characteristics on all treatments generally fulfilled the needs of a local premium grade. There were no treatment effects on weight of shoulders, middles, and hams; nor was there any evidence that treatments had affected distribution of muscle and fat within the side.

When carcasses were adjusted for weight of bone plus muscle in the side, there was no treatment effect on weights of tissues; nor on the distribution of bone plus muscle in the shoulder, middle, and ham.

Comparison of Meat Meals

A number of experiments were conducted to evaluate the feeding value of different brands of meat and bone meal for pigs. Preliminary results of this work indicated:

(i) Rate of feeding may influence the response of pigs to different meat meals or meat and bone meals. Under restrictive feeding, pigs appear to be able to tolerate different meat meals or meat and bone meals, despite large differences between the chemical compositions.

(ii) Restrictive feeding appears superior to full feeding followed by restrictive feeding, although producing a similar carcass in the same time.

(iii) As restrictive feeding appears superior, and reduces the variation in pig response to different brands of meat meal or meat and bone meal, this would appear the practical means of feeding diets that use these meals as the main source of supplementary protein.

(iv) As rate of feeding may influence pig response, this provides additional problems when trying to predict pig growth with short term chick or rat tests that use *ad lib* feeding.

Corn/Meat Meal Rations

Four experiments were conducted to determine the value of corn/meat meal diets for pig production. These trials demonstrated that corn/meat meal diets, compared with wheat/meat meal rations, induce markedly inferior pig performance.

This had occurred with different samples of corn and meat meal and different breeds and batches of pigs. Neither the addition of a mineral and vitamin premix, alone *or* in combination with the two commercially available amino acids (lysine and methionine), boosted the inferior performance.

The inferior performance did not appear to be related to either the corn or meat meal samples used in the trial, and only occurred when they were fed together. Neither did unpalatability appear to be the cause of the depressed performance. Possible causes include: (i) lack of mineral and vitamins, not included in the mineral and vitamin supplement; (ii) poor protein quality, resulting from a combination of corn and meat meal but not occurring when the corn was supplemented with other protein sources or when the meat meal was used in combination with wheat; (iii) a possible unidentified growth depressant factor in the corn/meat meal combination.

Livestock Production—Field Activities

SHEEP AND WOOL SECTION

Staff

Six New Positions.—Funds were provided from the Commonwealth Extension Services Grant for three new District positions. The appointment to each has been made.

The Australian Meat Board provided funds for appointment of three officers for the Sheep Fertility Service. The three have been appointed and have commenced their in-service experience by providing a service to four properties.

In-Service Training.—The principal livestock officer (sheep and wool) and four officers attended the Commonwealth Sheep and Wool Extension Officers' Refresher Course. Three officers attended the Department's Extension Methods School.

Five officers were given periods of in-service training with experienced District officers before being appointed to District duties.

Conferences/Seminar.—The value of the annual seminar in keeping officers abreast of research developments was again demonstrated in the discussions the seminar provided between extension and research officers. It was held at Armidale. The theme was "Efficiency in Sheep Production: Higher Stocking Rates and Grazing Management". Officers of the CSIRO, the University of New England and the Division of Animal Industry addressed the seminar.

The methods of arriving at economic stocking rates put forward at the seminar are to be implemented on a co-operative basis by District officers.

The principal livestock officer (sheep and wool) and the Dubbo District livestock officer (sheep and wool) attended the Department's Extension Policy and Design Workshop.

Extension Service

The drought, particularly in the south, influenced the Section's extension activities. Sheep raisers made increased demands for information, particularly relating to reproductive efficiency and the drift system of lambing. Through mass and group media continuing advice was given on methods of mitigating drought effects.

There was increasing trend by District sheep and wool officers towards whole-farm advice.

Requests for fleece measurement advice decreased this year because many graziers could not reduce flock numbers by culling; their flock size was already below normal because of drought conditions.

Producers displayed keen interest in co-operative demonstrations of managerial, reproductive, and grazing techniques. Many made facilities available on their properties for the demonstrations. Availability of trailers and scales in the District services made a major contribution to successful implementation of demonstrations. The following tabulation summarizes the numbers and types of demonstrations set up:

Subject	Demonstrations
Stocking management and pasture utilization	25
Drought and supplementary feeding	5
Fertility studies	15
Selection programmes and growth rates	29
Mating of ewe lambs	8
Nutritional studies	5
General management	25
Lifetime performance: Twin/single	8
Total	120

Extension programme planning was implemented. Programmes for the coming year's activities have been formulated by the officers. The common primary goal is to increase "per head" and "per acre" productivity by raising reproductive rates, stocking rates and overall efficiency.

Activity Statistics.—The following table summarizes the extension activities of officers of the Sheep and Wool Section:

	1966-67	1967-68	Percentage Increase or Decrease
Number of property visits	2,856	2,739	− 4·1
Co-operative field demonstrations	100	120	+20·0
Sheep ranked on production	88,107	78,221	−11·4
Field day sessions and group talks	298	362	+21·5
Sales and shows attended	119	107	−10·0
Radio, press, and TV presentations	459	543	+18·3

The reduced totals for "property visits" and "sheep ranked" were because of the drought effect on sheep numbers. Similarly, the need to disseminate information on drought strategy was a factor which increased the use of group and mass media.

Production Trends in Sheep and Wool Industry

More Acreage to Wheat.—Two notable trends were the widespread increase in wheat sowings and the maintenance of stocking-rate per grazed acre even though sheep totals were lower.

Lamb and Crossbred Wool Sires.—Lamb production held but low price for the crossbred wool was source of concern. This price factor stimulated interest in the Dorset Horn as sire for first and second crosses, and also in use of finer woolled Merino ewes with Border Leicester and Dorset Horn rams. Popularity of the Border Leicester remained high.

Trend to Medium and Fine Wool.—Many pastoralists changed from the stronger woolled breeds and crossbreds to Merinos. There was also a trend to medium and fine wool Merinos by the Merino Breeders. Some interest was shown in fibre diameter to determine spinning quality of wool.

More Lucerne.—Lucerne became increasingly used as a pasture species for sheep and has proved its value as a drought tolerant plant. It was extensively sown along the Darling River under irrigation. A trend in feeding forage-harvested green lucerne on dryland runs, as a more effective method than grazing, was set in that area.

Spring Lambing.—The proportion of prime-lamb producing flocks that lambed in the spring and autumn did not greatly change and this was advantageous in helping to maintain year-round marketing of lambs. But the trend to spring-lambing Merinos continued and, with it, a greater proportion of autumn shorn flocks.

Measurement Trend.—Sheep-weighing scales were used by owners far more extensively than previously, particularly with hand feeding. More interest was evident in keeping records as part of improved farm-management.

Water Storage.—Water storages resulted in more water reticulation; some from municipal sources, but mainly from farm bores. Poor run-off into surface tanks contributed to this trend.

Sheep Operations on Departmental Farms

Because of the drought, sheep numbers on Departmental farms were minimized. There were some 18,000 sheep on these farms at the end of June, 1968.

Liaison with Other Departments

Assistance and advice was given to various Government Departments possessing sheep. Liaison was maintained with the Lands Department in relation to closer settlement.

Information on the preliminary and final estimates of wool-cut per sheep, anticipated lamb-marking percentages, and increase and decrease of sheep population was supplied to the Commonwealth Department of Primary Industry for use in the Bureau of Agricultural Economics annual survey of sheep and wool industry. The co-operation of the Bureau in other matters and that of the CSIRO are appreciated. Valuable support by these organizations has been given at the annual seminars.

Close contact was maintained and assistance given to the Rural Youth Organization. An officer of the Sheep and Wool Section was a Departmental representative in the Rural Youth Council.

BEEF CATTLE, HORSES AND GOATS SECTION

Staff

New District Officers.—Two new beef cattle officer Districts, headquarters at Wagga and Tumut, were opened. A further three officers filled vacant District positions.

In-Service Training.—Three officers completed periods of training on properties in northern Australia in 1967. Another three commenced similar training early in 1968. One officer has undertaken a cloud-seeding course.

Seminar.—The section held a successful seminar for officers at Trangie Agricultural Research Station. A wide subject-matter field was covered.

Extension Service

Besides normal duties, the District officers of this Section were under continuous heavy pressure coping with problems brought about by prolonged drought.

Beef Cattle Breeders' Competition.—Although seasonal conditions were adverse this collaborative project with the Agricultural Bureau and the Rural Bank of N.S.W. was again staged successfully. Entries were slightly in excess of 100; most satisfactory in view of the drought. This competition has been held for 16 successive years. It has been heavily supported and even in drought the entries have not been below 100. The competition owes much of its success to its simplicity.

Beef Industry Trends

Feeding for Survival.—Drought obliged many owners to feed their cattle for survival. A favoured few were able to take advantage of the situation and feed for production. This may be the shape of things to come, particularly if the prevailing price structure persists.

Improvement of Breeding Stock.—Performance recording of beef cattle to improve the selection of breeding stock has shown important developments since this project was commenced in 1956. There has been a continuing expansion and during the year further demonstration herds were included.

There has been widespread acceptance of performance testing in a number of areas in the State, with livestock officers receiving increasing requests for guidance in implementing the practice in both stud and commercial herds. The availability of the automatic data processing system for recording production traits in demonstration herds meant that, in addition to providing more complete information, additional time was available for follow-up work. Greater educational value was thereby achieved.

Because the usefulness of records in an effective selection programme depends on minimizing environmental influences by adjusting for those which can be measured accurately, the data collected was analysed as reported in the beef cattle research section of this report.

The Department's Stock

Sale of Stud Stock.—There was a heavy demand for the Department's Angus and Poll Shorthorn bulls and Arab horses.

A draft of nine bulls from the Angus stud at Trangie was sold to one buyer. Angus breeders' awareness of the benefits of the herd improvement scheme being undertaken at Trangie Agricultural Research Station has increased, and there was evident competition for the higher-performing bulls.

Sydney Royal Show Successes.—At the 1968 Sydney Royal Show the Department exhibited a team of Arab horses from the Wagga and Hawkesbury Agricultural Colleges. The Department's entries won five of the six Classes and also the Stallion Championship, Mare Championship and Supreme Championship.

PIG SECTION

Staff

Annual Conference.—The 1967 annual conference of pig production officers was held at head office. All livestock officers of the Section and those engaged in pig research attended.

In-Service Training.—The training of junior livestock officers of the Section continued at the Agricultural Colleges and Research Stations. Junior officers also attended the school for pig raisers as part of their in-service training.

Extension and Regulatory Services

Activity Statistics.—The extension and regulatory activities of livestock officers (pig) are summarized statistically in the following tabulation, with four years' comparisons:

Activities	1964-65	1965-66	1966-67	1967-68
Farm visits	1,707	1,564	1,461	1,844
Meetings attended	61	68	71	85
Pig Sales attended	189	150	114	121
Field Days attended	17	32	19	35
Bacon Factory and Abattoir visits	101	66	44	51
College and Research Station visits	58	74	51	57
Shows attended	19	17	16	28
Lectures and Demonstrations given	82	84	104	87
Swine Branding Act inspections	47	19	22	27
Stock Food and Medicines Act inspections	..	17	32	12
Publicity statements prepared	54	113	76	116
Radio and Television sessions	72	113	83	126

All extension officers handled in addition to the activities indicated in that tabulation a constant stream of requests through personal interviews and by letter and telephone for advice on all phases of pig production. In three Regions, the livestock officer (pig) acted also as officer-in-charge in the absence of the Regional Supervisor.

C.E.S.G. Demonstrations.—Demonstrations to show the effect of feeding meat meal and different levels of meat meal with wheat to growing pigs were conducted on four farms. These demonstrations showed that the addition of 20 per cent meat meal to wheat gave the most economical growth and best carcass quality.

The demonstrations are now being continued to show the effect of replacing part of the meat meal supplement with fish meal.

Schools for Pig Raisers.—The annual school for pig raisers attracted 85 applications, including four from Victoria. The school was, as usual, restricted to 40 pig raisers from New South Wales. All parts of the State were represented.

One-day schools were also conducted at Hillston (attendance 35), Gilgandra (65), Young (35), Cowra (60), and Trundle (40).

Industry Production

Pig numbers reached record levels. This followed the record of 77,000 brood sows at 31st March, 1967.

Pig meat production, despite the record pig population, only showed about 6 per cent increase. This was because of the high proportion of pigs slaughtered at lighter weights, for consumption as pork. The latter was at a high level throughout the year.

Baconer production decreased slightly. But bacon and ham supplies were sufficient for the existing demand.

The heavy supply of pigs did not affect prices until late in the year. Then porker prices became irregular and at quite a few centres fell below prices being paid for baconers.

The Department's Herds

Large White, Berkshire, Landrace and Tamworth breeds were maintained at Hawkesbury, Wagga, Wollongbar, and Grafton. At Hawkesbury and Wagga Agricultural Colleges they were mainly for instruction but also ration purposes. At the Wollongbar and Grafton Research Stations the herds were used for research. New blood lines were introduced to the herds at Hawkesbury College. A programme of culling aged and unsatisfactory brood stock was pursued.

In all, 1,144 pigs were disposed of: 77 stud pigs and 403 market pigs sold, 213 pigs for research uses, and 451 for rations at the Colleges.

Swine Compensation Act Activities

The Section's officers assisted in the preparation, examination and processing of many claims in respect of pigs ordered to be destroyed as "reactors" and carcases condemned. The Swine Compensation Fund receipts for 1967–68 were $134,815, the expenditure was $18,009, and the credit balance at 30th June, 1968, was $605,570, compared with $488,764 at 30th June, 1967.

The closing credit balance of the Fund is most satisfactory in view of the fact that from 7th July, 1967, the maximum market value allowed as compensation for grade or market pigs was increased from $20 to $50 and for stud pigs from $40 to $100. The expenditure remained low. Further, from 1st January, 1968, the Stamp Duty was reduced from 20 to 10 cents and despite that reduction the revenue exceeded expenditure by $116,806.

Swine Branding Act Activities

This year 1,453 new brands and 35 licences were issued, and 787 brands were transferred to new owners. A revision of the brand register also became necessary and involved checking 28,000 brands for possible duplications or the deletion of brands no longer in use.

Assistance to Other Departments/Organizations

Technical advice was given in the management of pig herds at institutions controlled by other Departments. These institutions were supplied with brood stock as required. The Department of Technical Education was provided with a part-time teacher in the correspondence course in pig raising.

The services of livestock officers (pig) were called on by farmers organizations, the Rural Youth Movement, the Australian Pig Society, the Royal Agricultural Society of New South Wales, numerous country show societies, and the Rural Bank of N.S.W. and the Commonwealth Development Bank.

The Royal Prince Alfred Hospital research was assisted by supply of pigs for the liver perfusion work. Medical research was assisted also by supply of pigs for research into heart and kidney transplants.

POULTRY SECTION

Staff

In-Service Training.—Five officers participated in the in-service training programme. One completed his training for appointment to a district.

One officer gained practical commercial experience on a commercial hatchery and a meat chicken farm. This proved a valuable facet of in-service training.

Extension

Schools for Producers.—The school for turkey producers was conducted at Wagga Agricultural College. Attendance was lower than in previous years, reflecting a trend to more specialized production from fewer turkey producers.

A successful school for poultry farmers was held at Hawkesbury College.

Group Field Days at Research Station.—A number of small group field days were conducted at Seven Hills Poultry Research Station by extension officers, at intervals of 4 to 6 weeks. These field days were based on the presentation and discussion of specialized material, and attendance was by invitation to individual producers. The attendances and response at these field days were good.

Annual Field Day, Hawkesbury.—The annual Poultry Farmers' Field Day at Hawkesbury College was the biggest yet conducted there. Theme was "Practical Nutritional Management".

Quarterly "Poultry Notes".—Continued production of this quarterly was well received by the commercial industry. A research review section has been started in it.

Poultry Officer (Meat Production).—The specialization of a poultry officer in poultry meat production has successfully expanded the service and enhanced the effectiveness of extension in this sector of poultry industry.

Activity Statistics.—Statistics of the 1967–68 extension activities of officers of the Poultry Section are summarized in the following tabulation:

Farms and hatcheries visited	720
Field days and demonstrations serviced	14
Visits to government institutions	21
Meetings attended for service	37
Articles for rural and poultry industry press	12
Radio broadcasts	8
Lectures and symposia presented	32
Schools for farmers serviced	2

Industry Surveys

Replacement Pullet Practices.—A mail survey was made. Response to this survey was good and is expected to yield valuable information for extension and research purposes.

Broiler Production Costs.—Officers of the Poultry Section liaised with Division of Marketing and Agricultural Economics also in a broiler survey designed to reveal costs of producing broilers and the management factors affecting these costs. Initial field investigation stages for this survey were started in May, 1968. The results should have value for all sections of the industry.

Random Sample Layer Tests

Random sample tests on layers were conducted at Hawkesbury College. These tests have been amended and expanded so that conditions are similar to those on quality commercial farms. The support for these tests remained good.

Poultry Industry Trends

Egg production continued to expand in 1967–68. Production for the first 36 weeks to June, 1968, was approximately 12 per cent higher than for the same period during 1966–67. A similar trend occurred in all States and led to a low average return to producers of 31 cents per dozen.

The Commonwealth Egg Marketing Authority's hen levy reached its maximum of $1 per bird per year (4 cents per fortnight) and the N.S.W. Egg Marketing Board imposed an additional cent per dozen pool to offset losses on excess production. Prices for good quality cull hens remained steady at 9 to 12 cents per lb.

The trend towards larger flocks on commercial farms continued. Most birds are now on farms of more than 2,000 capacity.

The trend towards increased specialization for pullet rearing also continued.

Meat chicken production increased during the year to 37.6 million chickens hatched, as against 34.2 million in 1966–67 and 26.1 million in 1965–66. There was overproduction in this section of the industry in the latter part of the year and prices to producers were reduced to 19.75 cents per lb.

Structure of the meat chicken industry became consolidated into four major integrated groups. Competition between these groups caused the over-production and low prices.

Controlled environment shedding for meat chickens increased, indicating the economic success of this type of housing.

Turkey production expressed trends similar to meat chicken production but less dramatic. It increased from 340,000 birds slaughtered in 1965–66 to 486,000 in 1967–68.

APICULTURE SECTION

Extension

Livestock officers of the Apiculture Section participated in beekeepers field days and meetings, extensively used radio and press and also increased their television activity. Co-operatively with country TV stations a special film was prepared for telecasting. Through the various media, the officers encouraged adoption of good bee husbandry and honey production and refining. They emphasized increased mechanization, and improvement of honey quality.

Honey Production High

In the north west and on the north-coast, beekeepers enjoyed a season of record production. Some from these areas reported it as their best season ever.

In the centralwest and on the central coast, production was above average. In Wellington, Molong, and Bathurst districts honey production from Yellow Box and Red Gum was the best for 20 years. In the southwest, yields were variable because of drought. On the south coast, there were particularly heavy concentrations of hives moved from the southern half of N.S.W. and parts of Victoria to work the winter flowering Spotted Gum.

Honey Prices Low

Honey prices were the lowest for many years. This was partly offset by the heavy production but rising costs for transport, material, and labour made it difficult for many producers to carry on. Export prices at the start of the season were unsatisfactory but improved towards the end. Some honey was exported to Western Australia, because of poor production there.

Disease Situation Good

Incidence of American foul brood disease (*Bacillus larvae*) was one of the lowest in the past 20 years. This reflects in great part the work of the Section which has gradually gained in strength and, by a policy of co-operation and education, has encouraged beekeepers to examine their hives regularly and report any suspected disease outbreak.

Apiculture Research

The main research project has been for production of improved strains of bees. Research grants by the Australian Honey Board enabled purchase of additional bee hives and equipment for production and testing of various strains.

Special hives and bee strains for genetic work were introduced by the livestock research officer (apiculture) on his return from overseas.

The Department's Apiaries

A record total of queen bees was made available to commercial queen breeders and apiarists from the Department's main apiary at Hawkesbury Agricultural College. These included specially developed lines produced with the aid of artificial insemination, as well as artificially inseminated queens directly available to beekeepers.

Very satisfactory honey crops were obtained from Departmental hives which were moved to the Tamworth and Bathurst districts.

DIVISION OF DAIRYING

General

STAFF

Administrative/Professional Changes

Deputy Chief of the Division, Mr C. E. Chapman, retired on 24th June, 1968, after almost 40 years service. Dr G. J. F. Smith, former Principal Dairy Officer, School of Dairy Technology, Hawkesbury Agricultural College, is now Deputy Chief of the Division. Mr H. E. Silversides was promoted from special duties at Head Office to the position of Principal Dairy Officer at Hawkesbury Agricultural College.

Staff at Australian Dairy Cattle Production Review Conference

This Conference, one of the most important ever held in Australia on dairy cattle production, was at Leura. The Division of Dairying was represented at the Conference by Divisional Chief Mr D. W. Crowfoot, and specialists D. R. Scott, B. O. E. Calder and R. L. R. Auld.

Every phase of dairy farm production was reviewed. Each sectional review was done by an appropriate Australian specialist. Departmental officers were involved in the reviews. Mr B. O. E. Calder reviewed the current work and knowledge in "Milk Handling on the Farm: Milking", and acted as subject collator. Mr R. Auld presented Dr L. Wardrop's review, "Calf Production and Herd Replacement: Rearing and Programming", and acted as subject collator.

Principal Dairy Officer's New Zealand Study

On a visit to New Zealand the Principal Dairy Officer (Herd Improvement) studied the use of farm milk meters. As a result, there will be field trials in N.S.W. immediately.

He also studied selected herds of the New Zealand Polled Jersey Breeders Association Inc. and assessed the bull "Ardachie Corley" as a very suitable source of semen for the Department's Polled Jersey Stud at Grafton Agricultural Research Station.

Representatives in Standards Association of Australia Committees

The Chief of Division of Dairying represents in the *Dairy Industry Committee;* the Deputy Chief in the *Butter Wraps Committee;* the Principal Dairy Officer (Extension) and the Senior Dairy Officer (Research) represent in the *Detergents and Sanitizers Committee;* the Principal Dairy Officer (Milk Products) represents in the *Factory Pipes and Fittings Committee;* and the Senior Dairy Officer (Research) in the *Milking Machine Components Committee.*

SEASONAL CONDITIONS AND PRODUCTION

Rainfall in dairying districts other than north coast was below normal. Drought prevailed in the southern and southwestern areas. Floods on the northern rivers in June, 1967, and further flooding in January, 1968, seriously affected milk production on river flats. Pasture damage was severe.

Supplementary feeding was extensive. Costs of purchased fodder were relatively high. Bran and pollard supplies were reasonable but oats in fairly short supply because of failures in grain producing areas.

An epidemic of ephemeral fever ("three day sickness") also troubled practically every dairy herd in the State. It caused rapid drop in milk production. Although fever is rarely fatal, many cows made very little recovery in milk production.

Production (from Commonwealth Bureau of Statistics) for 12 *months to* 31*st March,* 1968

Total Milk Production	318,973,000 gallons
Consumed as a whole milk (in Board Area)	98,986,000 gallons (31 per cent)
Consumed as whole milk (outside Board Area)	34,469,000 gallons (11 per cent)
Butter	75,380,156 lb
Cheese—	
Cheddar	11,498,394 lb
Cottage, Ricotta and others	924,355 lb
Milk Powders (all types)	71,366,000 lb
Condensory Products	24,755,000 lb
Ice Cream and Frozen Milk Products	19,095,000 gallons
Casein	Figures not available
Cultured Products (Yoghurt and Sour Cream)	Figures not available (estimated increase 20 per cent)
Number of Suppliers to factories	10,923 (866 fewer than in previous 12 months).

INDUSTRY TRENDS

Fewer Farms, Higher Total Production

The decline in number of registered dairy farms continued the trend apparent since 1948 and the total is now 10,923. But milk production continues to increase. Although the cow population in 1967 was 768,255, compared to 971,818 in 1957, the 1967 production per cow was a record 431 gallons. This was 35 per cent more than the 1957 production per cow. Production will continue to rise as smaller, marginal farms phase out of the industry and the remaining units expand.

Newer Dairy Foods

The dairy industry's economy is closely linked to New South Wales' position as a consumer State. Newer dairy foods are getting greater acceptance and this market is far more profitable than the basic butter and hard cheeses. Market milk sales now take 40 per cent of the total milk production. New developments in liquid milk foreshadow problems related to new definitions and updated regulations.

Dairy Industry Advistory Council

In April, 1968, the State Government set up a Dairy Industry Advisory Council comprising seven members: six from the industry, both primary and manufacturing, and the Chief of Division of Dairying. The Council is to:

(1) Investigate the structure of the Dairy Industry in N.S.W. with particular reference to the marketing of liquid whole milk and the production and marketing of manufactured dairy products.

(2) Advise on whether a State Dairy Industry Authority is desirable and should be phased into operation, to be responsible for the regulation and supply of liquid whole milk and manufactured dairy products in N.S.W.

(3) Advise on the powers, duties and functions of such an authority with due regard for the role of other Government instrumentalities and for any other Commonwealth or State marketing arrangements of a non-legislative character.

Bulk Milk System Finance for Farms and Factories

In March, 1968, on a recommendation by the Minister for Agriculture Cabinet approved preparation of a Bill to authorize provision of Government guarantees of loans made by lending institutions to dairy factories to acquire bulk milk handling and transportation facilities.

Guarantees are provided on the recommendation of and subject to such conditions as may be imposed by the Department of Agriculture for loans specifically related to the acquisition of these facilities.

This decision will have a far reaching effect on the industry. It will speed up the change over, from pick-up of milk cans at the farm to farm-refrigerated bulk storage and the tanker pick-up system. This system economises cartage and maintains milk quality at a level not possible in can-storage. The economies extend to the farm by allowing greater freedom to the farmer in spacing the milking times, and by saving up to 1½ hours labour a day in can-washing and conveying milk to the roadside.

Bulk Milk Collection

Collection of milk from farmers' refrigerated bulk tanks continued to expand. Six more factories commenced bulk pick-up this year, and earlier adopters continued to expand the method. Where factories have adopted bulk collection, the quality of milk and dairy products has improved. This is due to the milk being at lower temperature (40°F) on the farm until picked up, and to the fact that one tank is easier to clean and maintain than a number of cans.

"Milko-Tester", for Butterfat Content

The Milko-Tester to measure butterfat content of milk by a pseudoturbidity method has been approved by the Minister for Agriculture as an alternative to Babcock testing for payment on butterfat basis.

Detecting Antibiotics in Milk

The standards set have reduced the number of suppliers forwarding milk containing antibiotics. Laboratory checks using the Brom Cresol Purple test and the dye detection method are applied at the receiving platform.

NORTH COAST DAIRY FARM FEED-YEAR ASSISTANCE SCHEME

The first year of the scheme ended on 30th September, 1967. For the 12 months from 1st October, 1966, a total of 4,945 claims, involving 74,383 acres, were paid. The payments were assistance in providing pasture and crop seed and necessary fertilizer. The total was $1,018,929. The claim average was $206.05. Payments averaged $13.69 per acre. Dollar per dollar contributions by the farmers is a condition of the scheme and their personal expenditures in this respect totalled $647,014.

This first year of the scheme involved additional assistance, at $5 per acre, to defray establishment costs; a provision which has been eliminated from the second and subsequent years.

For various reasons, and mainly the unsatisfactory seasonal conditions at the normal period for pasture sowing, the returns for the year commenced 1st October, 1967, indicate a comparative slowing down in applications.

There have been requests to extend the scheme beyond the original areas. But the scheme is still confined to farmers in the Shires of Macleay, Nambucca, Bellingen, Coff's Harbour, Nymboida, Ulmarra, Maclean, Copmanhurst, Woodburn, Tomki, Kyogle, Terania, Gundarimba, Tintenbar, Byron and Tweed or traditionally a supplier to Dairy Produce Factories located in these areas.

Extension officers of the Division of Dairying are closely involved in the scheme. They chair the nine local committees. A policy committee is located at Head Office in Sydney but overall administration is decentralized through the Regional Supervisor of the North Coast Agricultural Region. He chairs the scheme's central committee at Lismore.

The scheme has lifted dairy production in the areas where it operates and enlivened and primary producers' awareness of the extension activities of the Department.

Extension, Education and Regulatory Services

DAIRY PRODUCTS GRADING AND QUALITY WORK

Butter

Grading.—The Dairy Products Grading staff made regular examinations of butter (and cheese) manufactured in N.S.W. and received at Sydney, Newcastle, Wollongong. Canberra, and Wagga for processing, distribution and storage before sale on the local market. Samples from Wollongong, Canberra and Wagga were received in Sydney for grading. Newcastle was visited regularly for grading. At Casino, butter was examined there before being cold-stored locally.

Details of the grading were sent to distributing agents, factory managers and District dairy officers for use in quality control and extension work.

Statistics from the butter grading were the basis of "Order of Merit" determinations by the Department of Agriculture and the continuous Grading Competition of the Royal Agricultural Society of N.S.W.

Quality in the substantial quantities of butter and cheese imported from other States was checked by Departmental Graders at the request of the selling agents.

The butter samples examined totalled 1,465,731 and 3,631 cheese samples were also examined. Powdered milk, butter oil and margarine also were examined as from time to time requested by manufacturers and distributors.

Biological and Chemical Survey.—Butter samples were taken regularly for biological examination by the Division of Science Services. The results were forwarded to District dairy officers and factory managers. Analyses for moisture and salt content were done regularly and these results also were forwarded to factory managers and District dairy officers.

Special Quality Investigations.—Special investigations in regard to quality defects were continued at various factories. The Biological Branch, Division of Science Services cooperated in several of these.

Judgings.—The Grading Officers were availed of as Judges in the Dairy Produce Section of the Sydney Royal Show, Newcastle Show, North Coast National and other country shows. They also judged competitions for the N.S.W. Division of the Australian Institute of Dairy Factory Managers.

Butter Wraps.—Experimental work was done in connection with surface deterioration of print butter and the use of various types of wrapping materials. The reports were supplied to the industry.

Continuous Butter Churn.—The Principal Dairy Officer (Butter) visited Yarram (Vic.) with Dungog Co-op. Dairy Society representatives to study the working of a continuous buttermaking machine subsequently installed at the Dungog factory. The grading staff co-operated with the factory management and Maitland District dairy officer in checking the machine's efficiency, and continued to check also the efficiency of a continuous buttermaker installed earlier at Norco factory, Lismore.

Retail Butter; Quality Control Survey.—Retail butter surveys were conducted in Sydney metropoltan area and country districts to determine the quality of butter at consumer level. Samples were subject to sensory grading and biological and chemical analysis. Irregularities detected were discussed appropriately with distributors and manufacturers.

Cheese

Cheddar Cheese.—Quality has improved but there is room for further improvement. Most factories have installed the necessary equipment for quality tests on milk as recommended by officers of the Division. Unfortunately, tests are not done regularly and sensory grading standards are not being maintained.

General factory hygiene has improved as shown by the improvement in bacterial counts, particularly coliform and staphlococci counts.

Cottage Cheese and Cultured Milk Products.—In the past 2 years the manufacture of yoghurt, cottage cheese and similar soft cheese types have expanded rapidly and are continuing to do so.

One company has increased cottage cheese production from one 300-gallon vat to two 2,000-gallon vats of milk, and yoghurt from a few 10-gallon can units to six 250-gallon bulk units. The company's other products include non-fat skim milk, whole milk flavoured, pure fruit yoghurts and cultured buttermilk.

This company, handling a very large quantity of surplus milk, recently sent a representative overseas to study manufacture and sales promotion of cultured products. Within 5 to 10 years it is likely to be marketing the whole of its surplus as cultured milk products. Its cultured milk products sales doubled in the past 6 months as a direct result of a packaging change from paper to plastic cartons.

The Range of Varieties Other Than Cheddar.—Varieties now manufactured in N.S.W. are Cottage, Ricotta, Plastic Curd types (Mozzarella, etc.), Roman, Parmesan, Fetta, Gouda, Pecarino, Edam and Blue Vein. With three factories at present making Italian types of plastic curd cheese and two more in the course of construction, there is implied enormous scope for these cheese types even though costs of milk supplies are high.

Consumption of processed cheese is expanding. For four factories now manufacturing it the 1967–68 production figures are not yet available but the estimated total is 3,375,000 lb.

Imported Cheese.—A new segment of work has arisen through a requirement of the N.S.W. Dairy Industry Act that all cheese for wholesale distribution must be stored in registered dairy produce stores.

The Quarantine Section of the Division of Animal Industry issues cheese "Permits to Land". The application form for Permits to Land has been modified to include name and address of place of storage. Division of Dairying receives a copy which is forwarded to the appropriate District dairy officer so that the Store and the cheese imports will be inspected regularly.

The information has been most useful to Division of Dairying in locating and registering Dairy Produce Stores. But the large number of Stores and shipments has made it impossible adequately to handle the inspections. In the past 6 months about 1,000 tons of cheese came into this State from overseas countries. Most of the 193 registered Stores are involved, and most of these in the metropolitan area. The amount of work involved, the condition of some of the cheese being imported, and insufficient staff to handle the inspections satisfactorily, comprise a serious problem for the Divison.

Of 300 issued Permits to Land only 30 cheese lots could be inspected. The results were:

Seventy-nine tons of hard varieties plus a quantity of brine packed Fetta were condemned by the Board of Health in co-operation with Dairy Division officers as unfit for human consumption;

Eight Remedial Orders were issued on Stores;

Four Consignments of Cheese and the respective Store were ordered to be fumigated because of live cheese mite and fly infestation;

Three prosecutions by the Board of Health;

In one instance, rat skeletons and rodent excreta were found in some crates together with evidence that the rodents had eaten into the cheese and had entered the crates in the country of origin.

Biological Survey; Cheese Quality.—This survey continues to be of great importance to cheese quality. Its help to dairy officers in locating and eradicating sources of biological contamination is instanced by the drop in number of samples showing high coliform and staphlococci counts.

Amendments to Export (Dairy Produce) Regulations.—The Regulations were amended to reduce from 38 per cent to 37 per cent the moisture content requirement in cheddar cheese. Labelling and packaging requirements were also amended.

Special Investigations.—Investigations into milk and cheese quality showed that most factory problems came from unsatisfactory grading of milk, failure to do regular quality tests, faulty starter propagation, and unsatisfactory hygiene standards; and *after manufacture* came from faulty handling, packaging, and storage.

Products Other Than Butter and Cheese

Production of condensory products in general, except unsweetened condensed milk, was lower this year. Ice cream, ice cream mixes and casein also showed decline.

Production of milk powders in general increased. The greatest increase was in skim milk powders, seemingly due to demand by recombining plants established by the Australian Dairy Produce Board in Asian countries. Unfortunately, a world glut of skim milk powder early in 1968 depressed prices and factories are looking for other outlets.

Buttermilk, skim milk and buttermilk mixtures, used mainly in stock foods, showed the next from highest increase.

Statistics of Dairy Industry Act Activities

Factories and Stores Registrations.—There were 65 new registrations of Dairy Produce Stores, 33 cancellations and eight transfers. There are now 194 registered. There are now 103 Registered Factories; after six cancellations and eight renewals in the period under report.

Forty-three Remedial Orders were issued in this period.

Margarine Manufacturing Licenses.—Six licenses to manufacture table margarine were issued and seven to manufacture cooking margarine. Seven permits to manufacture export table margarine were issued. This year the license to James Barnes Pty Ltd was transferred to Provincial Traders Pty Ltd.

Dairy Produce Factories and Equipment.—Applications, plans and specifications for two new cheese factories and one butter processing factory were received and approved. Plans and specifications were approved for major structural alterations to five factories.

Dairies Supervision Act

Supervision of dairies by Local Shire and Municipal authorities continued in many instances to be very unsatisfactory. As a result, the general standard of dairy premises is poor and without adequate supervision will further deteriorate. There are at least 370 unregistered dairies in the State, and most of these in shires with large numbers of dairies. Some shires accept a registration fee without even inspecting the dairy. In one shire less than 10 per cent of the 380 dairies registered comply with the Act's requirements.

Officers of the Department of Agriculture Division of Dairying have given technical advice as required, and jointly inspected dairy premises when requested by councils.

Pure Food Act

Warning letters were issued to 17 dairymen for failure to maintain dairy premises and equipment in a clean and sanitary condition. A copy of the letter was forwarded to the appropriate Local Authority under the Dairies Supervision Act.

One prosecution was launched.

Close liaison was maintained with Board of Health officers regarding storage of poor quality imported cheese (see previous column, this page).

DAIRY SCIENCE SCHOOLS

Twenty-two Dairy Science Schools were held, at various locations, to instruct and examine factory operatives and Hawkesbury Agricultural College Dairy Technology students for the Certificate of Qualification under the N.S.W. Dairy Industry Act. The twenty-two schools comprised 14 on "Milk Grading", 4 on "Milk and Cream Testing and Cream Grading", 3 on "Milk and Cream Testing" and 1 on "Cream Grading".

In addition candidates for Cheese Maker Certificates were examined at four cheese factories and candidates for Butter-maker Certificates at eleven butter factories.

Examination	Candidates	Competency Certificates Issued
Milk Grading	154	113
Cream Grading	49	32
Milk Testing	59	49
Cream Testing	55	45
Cheese Making	21	20
Butter Making	21	20
	399	279

OTHER SHORT SCHOOLS

Milking Machine Efficiency School.—This was held at Hawkesbury Agricultural College for 13 dairy officers and 2 livestock officers (dairy cattle). Lectures and demonstrations on milking machine installations, operation, maintenance, testing, and cleansing, on shed management and on research projects were given by Departmental specialists.

Factory Operatives School.—A special Milk Pasteurisation School was conducted by the Division at Bega, 22nd–23rd August, 1967, to increase the efficiency of factory workers operating milk pasteurisers. Lecturers included Departmental personnel and three specialists from firms concerned with dairy equipment, dairy engineering, dairy detergents and sanitisers. Bega Co-operative Dairy Co. made factory equipment available for the sessions.

Herd Recorders School.—Another successful school for herd recorders was held at Hawkesbury Agricultural College. This one in May, 1968, was the sixth such school since 1962 and marks the third year of the second round of the State's recorders.

Livestock Officers (Dairy Cattle) School.—In October, 1967, a refresher school for livestock officers (dairy cattle) was held at Deniliquin. Besides six livestock officers (dairy cattle), four dairy officers attended. The programme included visits to leading studs in the South Western Region and a stud in Victoria.

Judging School for Friesian Cattle Club.—The Friesian Cattle Club of Australia, N.S.W. Branch, had a two-day "Breed Promotion and Judging School" at Hawkesbury Agricultural College in September, 1967. Eighty members attended. The range of lectures was wide and the College herd was used extensively for demonstrations. The quality of the herd and its management received very favourable comment from the Breed Society members.

EDUCATIONAL COMPETITIONS

The Three-Years Dairy Farm Improvement Competition

District dairy officers again functioned as District Judges for the 1966–67 *Country Life* Dairy Farm Improvement Competition. The Bega District dairy officer was State Judge, assisted by the Bega District agronomist and a representative of the N.S.W. Milk Board. The Board is joint sponsor of the competition with *Country Life* newspaper.

The competition requires a farmer to participate for at least three years and has much to commend it. District officers advise the competitors on whole farm operation and management. Results in the two previous years provide comparisons for the final year of judging. Of the 47 entries, 36 have already been judged.

Factory Improvement Competition

A competition sponsored by Rurakura Developments was conducted for the first time, in association with the N.S.W. Dairy Factory Managers and Secretaries Institute. From 23 entries, Manning River Co-op. Society Ltd was the winner.

All phases of factory operation were taken into account, including buildings, surroundings, office accommodation and service to suppliers. The Deputy Chief, Division of Dairying functioned as State Judge.

COMMONWEALTH EXTENSION SERVICES GRANT (C.E.S.G.) DEMONSTRATIONS

The C.E.S.G. demonstrations conducted during the year comprised: (a) Soil stabilization of dairy holding yards, using sulphonated petroleum water soluble oil (a trade preparaiton); (b) Water treatment plants for purifying water for dairy use; (c) Vacuum silage packs.

Soil Stabilization in Dairy Holding Yards.—One demonstration is on red volcanic soil and the other on black river flat pug in the Lismore District. Each has existed for almost 12 months and is an accepted outstanding success. A feature of the product used is its ability to reduce dust menace as well as mud. The treatment at the demonstrated rate costs 10 cents per square yard of treated area.

Two well attended field days have been conducted on each farm. Enquiries for information from the demonstrations have come from all States and from New Zealand. Sheep and beef as well as dairy farmers and secondary industries have been interested enquiriers.

Water Filtration and Purification.—One farm unit comprising a sand and gravel filter, activated carbon filter and an ultra violet-ultra flow water purifier, has worked very successfully. Before the start of the demonstration an average of 35 per cent of cream produced was 2nd grade. A third line recirculation cleaning system has also been installed in the dairy and second grade cream is almost nil.

At least four similar installations are known to have been made because of this demonstration.

On the second demonstration farm similar filtration equipment was installed, plus an automatic chemical unit which feeds sodium hypochlorite solution into the feed water at a predetermined rate of 50 p.p.m. The water is stored and used for all dairy purposes.

Second-grade cream due to water contamination has been completely eliminated. The only cream downgraded has been due to carrot weed taint. Before the start of the demonstration three years ago an average of 15 per cent of cream produced was of second grade quality.

A number of similar units have been installed by district farmers.

Vacuum Silage Pack.—Two very successful demonstrations using the vacuum pack method of silage making were conducted in Murwillumbah District in co-operation with the District agronomist.

One pack was filled with 90 ton of hybrid sorghum and the other with 100 ton of maize and dolichos lab lab. The silage made in each instance was of good quality. One field day was held; attendance 45.

STATISTICS SUMMARIZING FIELD OFFICER ACTIVITIES

The activities of the field officers of Division of Dairying in their extension and regulatory duties have been summarized statistically as follows:

Farm visits	18,996
Factory visits	3,420
Field days and demonstrations attended	134
Field days conducted	42
Meetings and discussion groups attended	296
Schools and conferences attended	145
Radio and television segments contributed	704
Tutorial classes conducted	117

A number of the Senior dairy officers are also "Officer-in-Charge" at the District centre of the Department and two have been Acting Regional Supervisors. These are time-consuming responsibilities and have affected the field activity statistics.

Dairy officers handled numerous other duties besides those statistically summarized; office interviews, letters and telephone enquiries on matters relating to the Dairies Supervision Act, Dairy Industry Act and Pure Food Act, and general extension matters.

THE BOOK—"DAIRY FARMING IN AUSTRALIA"

The Principal Dairy Officer (Herd Improvement) and the Senior Livestock Officer (Dairy Cattle) revised four chapters for the new N.S.W. edition of the Commonwealth book *Dairy Farming in Australia.* These chapters were: Breeding and Genetics, Dairy Breeds in New South Wales, Herd Improvement in New South Wales, and Practical Breeding.

Herd Production Improvement Schemes

HERD RECORDING

Approved Expansion of Herd Recording Scheme

Demand for additional recording units increased to 18 during the year. Public Service Board approval was granted in May, 1968, to expand the scheme by adding 15 herd recorders, one relief recorder and one herd organizer early in the 1968–69 fiscal year.

At 30th June, 1968, the staff remained at the same strength at 12 months earlier, viz. 91 herd recorders, 11 relief recorders and 10 herd organizers.

Higher Fees for Recording

Recording fees have remained unchanged for almost 12 years but steadily rising costs have made a revision necessary. Fees will be higher as from 1st July, 1968. Members of all units have been advised individually by letter.

Official Recording (Registered Pure Breds Only)

Two hundred and eighty-seven herds were recorded, 12 more than in the previous year. This was without any increase in staff, and possibly reflected the change over to two 48-hour check tests in place of the two-monthly strip outs. Some 7,796 cows completed lactations of six months and over, including any cows exceeding the standard in a lesser period. Butterfat production average was 337 lb (an increase of 16 lb over the previous year). Milk production average was 8,259 lb (an increase of 350 lb over the previous year).

Group Herd Recording (Grade and Pure Bred Dairy Cattle)

The recorded cows totalled 87,259, an increase of 984 cows on 1965–66 and 18 more than in 1964–65.

Some 74,360 cows completed lactations of 6 to 10 months and averaged 5,957 lb milk, 4.24 per cent test and 252 lb butterfat. This, per cow, was 21 lb butterfat more than in the previous year and was the highest recorded production so far. Milk production was also up 417 lb on the previous year.

Some 5,952 cows completed short lactations of from 1 to 5 months. These averaged 2,182 lb milk, 4.12 per cent test, and 90 lb butterfat. The total of 5,952 cows was a pleasing reduction of 649 cows compared with the previous year. This was the second successive year wherein the number of cows recording for less than 6 months declined.

The "all in" average for 80,312 cows completing lactations of from 1 to 10 months was 5,677 lb milk, 4.23 per cent test and 240 lb butterfat. Their average of 23 lb butterfat more than in the previous year, a very creditable performance, meant also the highest recorded production for this section.

Part lactation cows totalled 6,947.

Total Herds Recorded

1,499 herds were recorded, in 91 Recording Units, with an average of 58 cows per herd; compared to 1,521 herds in the previous year, averaging 57 cows per head.

District Averages

District averages, for three Districts, were: Orange District: 923 cows, 8,570 lb milk, 3.62 per cent test, 310 lb fat; Deniliquin District: 9,830 cows, 6,517 lb milk, 4.47 per cent test, 291 lb fat; Maitland District: 8,810 cows, 6,948 lb milk, 3.97 per cent test, 276 lb fat.

Highest Recording Units

The highest recording units were: Unit No. 3, Windsor Dairying District: 292 cows and 327 lb fat; Unit No. 8, Deniliquin Dairying District: 943 cows and 312 lb fat; Unit No. 1, Orange Dairying District: 923 cows and 310 lb fat.

Production by Length of Lactation

The tabulation showed that as cows milked for longer lactations their production progressively increased. Cows milked for 1 to 5 months averaged 90 lb fat, for 6 months 153 lb fat, and for 10 months 302 lb fat.

Production of Age Groups

The tabulation showed that the 4–9 year old group had the largest number of cows (46,111) and with the highest butterfat average (265 lb). The 2-year-olds averaged 216 lb fat, and the 3-year-olds 235 lb fat, while the 10-year and over group averaged 255 lb fat.

Influence of Month of Calving and Length of Lactation

This tabulation showed a similar trend to that of the previous year: most cows calved between June and October; best production was from cows calving in May, June, July, and August; longest lactation came from cows calving in March, April, May, June, and July.

Group Recording, New Entry Forms

Use of the new Group Entry Form started on 1st January, 1968. This form was mentioned in the last annual report. It provides for Group Recording to be carried out in a manner similar to Official Recording, in so far as that a Group cow's history file has been established on magnetic tape. This has simplified the work of recorders, and will increase the accuracy of recordings.

Herd Recorder Competencies

Certificate of Competency in Milk Testing.—A further 13 herd recorders qualified for this certificate this year, making a total of 61 such certificates in the last 3 years and of 159 since March, 1962, when these were first issued.

Efficiency Checks.—Sixty-three efficiency checks were carried out on herd recorders.

SIRE SURVEYS

Herd recording data have been processed in two computer runs for the Sire Survey. The first run was the 1966–67 survey. The second was an interim run of the 1967–68 survey and comprised data from the Group Scheme up to December, 1967, and from the Official Scheme up to April, 1968. The latter run was specially programmed to provide, before the 1968 mating season commenced, the latest possible information on bulls standing in the State's Artificial Breeding Centres.

In both these surveys some 7,000 bulls with daughters in production were assessed. The outcome for natural survey bulls has not been published, but the outcome for the surveys of bulls standing in A.B. Centres was published after each run. Also, sire survey information both for natural and artificial breeding have been provided to herd recording members and others in this State, and to artificial breeding organizations throughout Australia.

CALF STUDIES

Calf Marking Scheme

Calves marked (i.e. tattoo identified) for the year ended 30th June, 1967, totalled 16,215, including 3,357 artificial insemination calves.

Since the start of the scheme 160,289 including 18,628 artificial insemination calves have been marked.

Calving Intervals

The effect of calving interval was studied. An interval of 11 to 13 months was found optimum for all breeds.

Calf Growth and Weight Studies

The average weekly gains in weight, height, and girth of dairy calves were studied, in all breeds except Ayrshire, for effect on subsequent production of milk and butterfat.

There was no significant correlation, and co-efficients of determination (less than 12 per cent) were low for all breeds, at weaning and at one year, for all three factors.

Number of lactations also showed no significant correlation, and co-efficients of determination values were less than 3 per cent.

Under the nutritional conditions of this study all calves were being fed at a very high plane of nutrition.

SOLIDS-NOT-FAT (S.N.F.) RECORDING

Two Experimental Recording Units

The two Experimental Recording Units in this project continued satisfactorily. One is in the Parramatta-Windsor Dairying District. The other is in the Nowra Dairying District.

Collection of information began in April, 1961. Since the report for the 12 months ended 30th June, 1967, the analyses of effects of stage of lactation and season of year on per cent butterfat, on S.N.F. per cent, and on lb of dairy milk have been completed. In all, 450 lactations per breed were analyzed, for the 6-year period 1961 to 1967.

It was found that S.N.F. (per cent), butterfat (per cent), and total solids (per cent), start high, drop until the second or third month, and then climb until the end of the lactation. The percentage S.N.F. at the end of the lactation can be higher than at the start.

Season of the year was found to have an effect regardless of stage of lactation. S.N.F. (per cent) showed a peak in the spring and, with some breeds, a second peak in the autumn. The low period was in summer. Butterfat (per cent) had two peaks a year, the major one in the autumn, the other in spring; winter being the low period.

Genetic Effects—S.N.F.

Contemporary comparisons, using first calf daughters only, were run on all Artificial Insemination bulls, on herd bulls in the Departmental herds, and on farmers herd bulls in herds at present recording under the Research Grant and in the special S.N.F. recording project in Dairy District No. 5.

Average S.N.F. (per cent) of daughters and contemporaries, as well as the difference in S.N.F. lb between daughters and contemporaries, and the weight given each bull, were calculated. A comparison of butterfat and S.N.F. contemporary comparison for all these bulls were made. Results are not yet available for publication. Milk production showed a peak in spring, with winter low.

Age and breed averages on S.N.F. (per cent) were up-dated to include the 1967 data.

The relationship, to later production, of first production records of S.N.F. (per cent), butterfat (per cent), and milk production (lb) was investigated and found to be non-significant, for all breeds.

The effects of feed units, protein units and the feed/protein unit ratio in the feed was investigated for all breeds. While results were mainly non-significant they pointed to the effect of protein units being greater than feed units and that the protein/feed unit ratio is of great importance. Further studies into these effects are now being organized.

On a herd basis it was found that the feed the cow was getting 1 to 2 months prior to the recording date, rather than on the recording date, had a significant correlation with the S.N.F. (per cent). For butterfat on a herd basis, it was found to be the feed 3 months prior to the recording date that had the significant correlation. For milk production the feed on the date of recording was most significantly correlated.

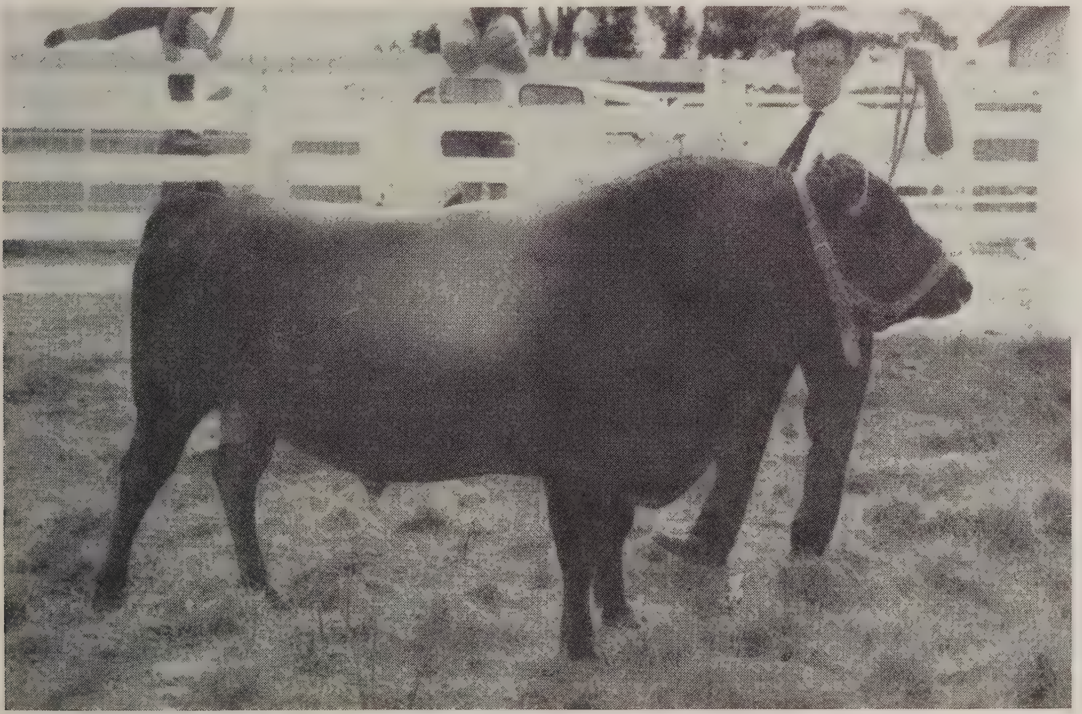
An analysis of variants was run on the S.N.F. (per cent) of cows in good, fair, and poor condition. They were found to be significantly different from each other. Cows in good condition had an average S.N.F. (per cent) of 8.62 per cent; in fair condition 8.57 per cent; in poor condition 8.42 per cent.

An analysis of variants for the effects of various roughages on S.N.F. was also commenced. Results indicate that: brewers grain (8.79 per cent) is significantly different at the 1 per cent level from cotton seed offal, meadow hay and corn silage, but not different from lucerne hay and sorghum silage; cotton seed offal (8.60 per cent) is different from lucerne hay and corn silage at the 1 per cent level, but not different from meadow hay or sorghum silage; meadow hay (8.40 per cent) is different from lucerne hay and corn silage at the 1 per cent level, but not different from sorghum silage; lucerne hay (8.44 per cent) is different from corn silage at the 1 per cent level but not different from sorghum silage; corn silage (8.58 per cent) is different from sorghum silage (8.59 per cent) at the 5.0 per cent level.

As a result of this analysis a further trial is being run at Hawkesbury College, using wet brewers grain and other roughage and a pair of identical twin A.I.S. heifers. Other foods besides brewers grain and meadow hay will be included in this project in due course. Meantime a significant difference in S.N.F. (per cent) is noted as between these two roughages; an average of 8.54 per cent S.N.F. for brewers grain and 8.56 per cent for meadow hay.

A joint project has been set up with Division of Animal Industry at the Wollongbar Agricultural Research Station, examining the S.N.F. (per cent) effects of feeding.

For all breeds, no relationship has been found between age at first calving and S.N.F. (per cent) and dairy milk production (lb). Co-efficient of determination was very low, generally under 25 per cent.



Semen Source: N.Z. Polled Jersey "Ardachie Corley"

Bulls in select herds of the New Zealand Polled Jersey Breeders Association Inc. were assessed by a Departmental specialist. He chose "Ardachie Corley" as a source of semen to be imported for the Polled Jersey stud at Grafton Agricultural Research Station

Survey for Detection of Mastitis Incidence

As a prelude to the Department of Agriculture launching a mastitis control programme in N.S.W. the Division of Dairying has surveyed bulk milk receivals at factories, statewide, to determine the incidence of mastitis. Modified Whiteside testing kits were supplied to each Dairy District. The results for 4,049 samples of bulk milk disclosed *at least* 23 per cent of the samples to be contaminated.

Follow-up work using the Californian mastitis test for quarter-testing on the farm has confirmed the Whiteside test results.

Dairy Research Unit at Hawkesbury College

This section of Division of Dairying activities has been reported under "HAWKESBURY AGRICULTURAL COLLEGE" (see page 148).

Government Herds

Achievements in the Government dairy herds have been at a high level and consistent with the previous few years.

COMPETITIVE, SHOW RESULTS

Teams were exhibited at local Shows and at the Sydney Royal and North Coast National with very satisfactory results. At Sydney Royal Show cattle were exhibited from Hawkesbury Agricultural College, Wagga Agricultural College, Yanco Agricultural College and Research Station and Grafton Agricultural Research Station. The Guernsey, Jersey and A.I.S. teams acquitted themselves well but Hawkesbury Agricultural College performance (Friesians) was quite outstanding.

This Friesian exhibit was the "Most Successful Exhibit" in the Friesian Section for the eighth successive year. The College also gained First Prize for "Most Successful Breeder".

In all, Departmental stock shown at the Sydney Royal Show gained thirteen First Prizes, six Seconds, eleven Thirds, and five Fourths. In addition, eight animals were submitted for sale at the Royal Show Sales and met keen demand. Top price was $500 and the eight averaged $365.

PRODUCTION IN GOVERNMENT HERDS

Production from the Government dairy studs was maintained at a very satisfactory level. The five studs were recorded in the official section of herd recording.

Hawkesbury Agricultural College Friesian stud achieved Third place in the section for "All Breeds and All Herd Sizes—Group", for butterfat, and Second place in the section for "All Breeds, for Herds with 40 or More Cows Recording". Production of this herd was 12,860 lb of milk, 3.8 per cent, 484 lb of butterfat with 55 cows completing lactation. This was amongst the highest butterfat averages ever achieved by a Departmental herd.

Wagga Agricultural College had the highest average milk production for a Jersey herd in the "40 Cows and Over Group"; and the second from highest average butterfat in the same group.

Yanco Agricultural College and Research Station had the highest producing Guernsey herd, for both milk and butterfat, in the "15 to 39 Cows Herd Size Group"; also top butterfat and second from top milk herd in the "All Herd Size Group".

The Yanco Agricultural Guernsey herd gained the Newcombe Cup for the herd with the six highest producing Guernseys in N.S.W. Butterfat production average of the six of the top cows was 620 lb.

The Department had a total of 10 Class Leaders in the various breed age groups.

Following is the Table of Production for the Government herds for 1965–66 and 1966–67:

Herd		Av. Milk (lb)	Av. B/Fat (lb)	Cows
Hawkesbury: Friesian	(1965-66)	12,872	464	48
	(1966-67)	12,869	484	55
Yanco: Guernsey	(1965-66)	8,718	436	42
	(1966-67)	8,280	426	27
Wagga: Jersey	(1965-66)	8,125	402	42
	(1966-67)	8,829	436	40
Grafton: A.I.S.	(1965-66)	8,967	352	34
	(1966-67)	8,356	344	48
Grafton: Polled Jersey	(1965-66)	6,894	317	39
	(1966-67)	7,298	350	43

BREED IMPROVEMENT MATTERS

Stock Purchased for Government Herds

Several animals were purchased this year for use in Departmental herds. These included "Hawkesbury Lenora King 2nd", a Friesian bred by Hawkesbury College, repurchased ($600) for use at the College, and a top quality Guernsey cow "Bellville Free Martha" purchased ($1,000) for Yanco Agricultural College.

Arrangements were made to import 400 ampoules of semen from the top proven Polled Jersey Bull "Ardachie Corley" which has bred well in the North Island of New Zealand. Semen from this bull is to be used in the Polled Jersey project at Grafton Agricultural Research Station.

The Perpetual Trustee Company donated to the Department the stored semen from the Estate of the Late E. Y. Seymour, including semen from "St Maur 141 Hill"—one of the top proven Guernsey bulls in N.S.W.

A collection of semen from the Champion Friesian bull "Golden Valley Rex" was donated by the owner to the Hawkesbury Agricultural College herd.

Breed Society Classifications

The Department's Guernsey, Jersey and Friesian herds each took part in the respective Breed Society Type Classification Programme with very satisfactory results.

Department's Bulls for Artificial Breeding Centres

Fifteen Departmentally owned bulls and twelve bulls sired by Departmentally owned bulls are at present in use in the State's Artificial Breeding Centres. Bulls bred by this Department are also in Artificial Breeding Centres in Western Australia, Victoria, and Queensland. Three new bulls were forwarded to A.B. Centres this year.

The Polled Jersey Project

The Polled Jersey Project continued to develop despite some problems. This year for the first time, the Jerseys at Grafton Agricultural Research Station out-produced the A.I.S. herd on a butterfat basis, with about equal numbers of cows milking in each herd. Seemingly the earlier loss of production caused by need to concentrate on the polled factor has been overcome.

There does not appear to be an increase in inherited blindness among the herd. Relaxation of semen importation regulations will enable use of a New Zealand top proven homozygous polled bull. He has no evidence of genetic abnormality and is unrelated to the Grafton stock. This should help to control this problem.

DIVISION OF SCIENCE SERVICES

Administrative Changes

This Division now comprises only the three Branches: Biology, Entomology and Chemistry. As from March, 1968, the National Herbarium ceased to be Botany Branch of the Division of Science Services.

The National Herbarium combined with the Royal Botanic Gardens for administrative purposes is now directly responsible through the O.I.C.—the Director and Chief Botanist—to the Director-General of Agriculture.

A change of some interest has been made also in designation of the second-in-charge of each Branch. Formerly designated Senior Biologist, Senior Entomologist, Senior Chemist, respectively, these positions now are designated Deputy Chief Biologist, Deputy Chief Entomologist, Deputy Chief Chemist. Similarly the Senior Botanist, National Herbarium, is now designated Deputy Chief Botanist.

Biology Branch

GENERAL

Retirement of Chief Biologist

Mr W. S. Sutton, Chief Biologist, retired on 15th March, 1968, after 43 years service. Dr L. R. Fraser was appointed Chief Biologist and Mr R. J. Conroy, Deputy Chief Biologist.

Overseas Study, Advanced Post-Graduate Training

Mr R. D. Pares has returned from 9 months study of electron microscopy, serology and other techniques of virus identification at the University of California, Berkeley. He visited also centres of plant virological research in U.S.A., Canada, United Kingdom, and Europe.

Mr R. J. Roughley continued his studies at Rothamsted Experimental Station, England, towards the degree of Ph.D. Mr A. M. Smith is on study leave at the University of Sydney, working towards the degree of Ph.D. Mr A. C. Robinson, undergoing in-service training at the Division of Plant Industry, CSIRO, Canberra, is working towards the degree of M.Sc.Agr. Four other officers are working towards the Master degrees, externally.

The M.Sc.Agr. was conferred on Mr R. W. McLeod and on Mr R. N. Allen.

Biology Branch—Plant Pathology Section

CEREAL DISEASES

Wheat Diseases

Barley Yellow Dwarf Virus (BYDV).—Following reports of widespread yellowing of wheat in northern areas a survey was conducted to assess BYDV infection. Yellowing was quite widespread in most districts especially on lighter soils. However, the symptoms and pattern did not resemble BYDV and subsequent laboratory tests on plants collected in the field failed to show the presence of this virus. Some BYDV infection was present this year but it was not a general problem. Most of the yellowing resulted from nutritional disorders.

Loose Smut (Ustilago nuda).—A trial was laid down at Rydalmere to compare the efficiency of chemical seed treatments, hot water soaks and steam-air treatments for control of this seed-borne disease.

Hot water soaks gave complete control as expected, but this type of treatment is applicable only to small quantities of seed.

An experimental systemic fungicide (vitavax) was promising on naturally infected grain but disappointing on hand-inoculated grain. Germination of seed treated with this fungicide drops considerably after six months storage. Trials with the systemic are continuing.

Other seed dressing fungicides and steam-air treatments were ineffective.

Cereal Cyst Nematode (Heterodera avenae).—This disease not previously recorded in N.S.W. was found during a survey of south-western wheat areas. Extent of infestation in N.S.W. is not known. So far it has been found and definitely identified on only one farm in Koraleigh district on the western edge of the wheat belt—adjoining infested areas of similar mallee soil in Victoria.

In Victoria, infestations occur on light mallee soil and on friable black soils in the Wimmera district. The nematode could probably establish itself in similar soils used for cereal production in N.S.W.

All of the hosts of this nematode are in the grass family. They include the cereals wheat, oats, and barley and common grasses such as cocksfoot and ryegrasses. *H. avenae* is widely distributed in northern Europe and Great Britain and has been found in many other countries including Italy, Israel, India, South Africa, Japan, and Russia.

Rotation of cereal crops with fallow and non-host crops is the basis of practical control. The nematode increases rapidly under preferred hosts such as wheat and oats and damage is most severe where these are grown continuously. For heavily infested soils three years without a susceptible crop is usual before cereals such as oats or wheat can be safely grown.

The persistence of this nematode under non-host plants suitable for N.S.W. conditions, and the reaction to it of cereal varieties used in N.S.W., will be examined.

Oat Diseases

Loose Smut (Ustilago avenae).—The trial laid down last year to investigate strain relationship and discover sources of resistance was repeated in an attempt to get a more significant result. Several facts emerged, but further testing is needed to confirm them.

There appear to be at least three strains of the loose smut fungus in N.S.W. Avon and Mugga were the only oat varieties immune to all strains tested. All other varieties used were susceptible to at least one strain. The existence of several strains of loose smut is important for plant breeders who must ensure that resistant varieties are immune to all strains.

Barley Yellow Dwarf Virus.—This was again prevalent in the oat varieties being tested for loose smut resistance. Field observations confirmed last year that Avon is most tolerant and Orient and Ballidu most susceptible.

Maize Diseases

Maize Mosaic.—Sixty-six inbred maize lines were tested for resistance to the virus. Much of this work was in the controlled environment growth cabinet during winter. This saved considerable time.

Results from the Rydalmere tests in conjunction with results under field conditions at Tamworth Agricultural Research Station indicate that there are sources of resistance and resistant hybrids could be developed.

Genetic Leaf Striping.—A chlorotic leaf striping was again present in some Iochief sweet corn crops. Crops inspected in Windsor district showed up to 20 per cent incidence and some considerable yield losses.

Previous work has shown that this is a genetic disorder transmitted through the female parent.

Rice Diseases

Helminthosporium Leaf Spot.—This was not observed during the 1967–68 season.

DISEASES OF FODDER AND PASTURE PLANTS

Lucerne Diseases

Bacterial Wilt (Corynebacterium insidiosum).—The intensive survey for this was continued throughout N.S.W. No case of bacterial wilt was found. The disease is either not present in N.S.W. or is very restricted. Quarantine measures controlling movement of lucerne material into N.S.W. are still in force as a safeguard against introducing this serious disease.

Witches Broom.—This condition appears to be in all lucerne areas, and incidence is increasing. In some stands infections of up to 60 per cent have been noted.

It is now suspected that two separate agents can induce a Witches Broom type of growth in lucerne. A leaf-hopper transmitted virus has been known for many years as a cause, but most Witches Broom specimens examined in the 1967–68 season were found by Entomology Branch to be infested with lucerne bud mite (*Aceria medicaginis*). Only two specimens were not infested with mites and a virus is suspected in these.

Vetch Diseases

Vetch disease investigations continued at Wollongbar.

Post emergence damping off (*Pythium* spp.) was partially controlled in the field in 1967 with an in-furrow application of dexon at 8 oz/acre at sowing. Untreated vetch yielded 206 lb dry matter/acre, and treated vetch 604 lb/acre. Higher rates of dexon provided better control of disease symptoms but were phytotoxic.

Six sites have been sown to vetch this season to examine the effect of 8 oz dexon/acre applied with the fertilizer under a wider range of conditions. Two times of sowing are in the trial. Rainfall in autumn was insufficient to favour severe disease and very little response to the fungicide has been observed.

In a separate trial different rates of dexon were compared when applied to the seed or mixed with the fertilizer. Here, also, disease development was too low for assessment of treatments.

A comparison of disease resistance in *Vicia angustifolia* P787, *V. articulata* CPI 26319, *V. atropurpurea* CPI 10376 and CPI 16632, *V. calcarata* F.P., *V. dalmatica* CPI 24123, *V. dasycarpa* CPI 15095 and CPI 9189, *V. disperma* CPI 10213, *V. ervillii* CPI 15272, *V. faba, V. hirsuta* CPI 10488, *V. leganyana* CPI 22871, *V. lutea* CPI 16638, *V. michauxii* CPI 23335, *V. narbonensis* CPI 20505, *V. pannonica* CPI 22907, *V. sativa* Golden Tares, CPI 15504, CPI 20515, CPI 26867, and CPI 32228, *V. varia* W 482, and *V. villosa* CPI 16486, has commenced. Growth in methyl bromide sterilized soil and in soil naturally infested with the post emergence damping-off pathogens are being compared.

More detailed studies, using larger plots, are also being made on Golden Tares, CPI 15095, CPI 15504, CPI 26867, PI 4297, PI 787, CPI 21979, CPI 26319, CPI 16632, and CPI 23335. Observations are also being made on other diseases of vetch in these nursery plots.

Root rot (sterile fungus) this season was as severe as usual.

The cause of bacterial blight has now been identified as *Pseudomonas stizolobii.* This appears to be the first record of this organism in Australia and the first record, in the world, of its infecting *Vicia* spp. in the field. The bacterium has also been found on field-infected velvet bean and white clover on the north coast. It has also infected red clover and sub-clover following artificial inoculation in the glasshouse.

This work on *Pseudomonas stizolobii* has been done in co-operation with Dr A. C. Hayward (Queensland Department of Primary Industries). The laboratory and glasshouse studies are being prepared for publication.

Glycine Diseases

Bacterial Blight (Pseudomonas phaseolicola).—This continues to appear in glycine stands, but causes no appreciable yield loss in the variety Clarence.

Lablab Bean Diseases (Dolichos lablab)

Stem Rot (Sclerotium rolfsii).—This was particularly common last summer, associated with the heavy rain periods in October and January followed by hot humid weather. The fungus was also recorded on lucerne.

Grass Diseases

Kikuyu Yellows (cause unknown).—The condition continued to spread and has led to considerable farmer concern. It is being investigated.

Dollar Spot (Sclerotinia homoeocarpa).—A new experimental fungicide not yet commercially available offers promise for control of this common disease of bent and couch grass. In a trial at a metropolitan bowling club this fungicide (benlate 1991) gave better control than did the corrosive sublimate standard recommendation.

Other Fodder and Pasture Plant Diseases

Root Rot of Irrigated Safflower.—Root rot was widespread and caused considerable yield losses. Gila, the variety credited overseas with some resistance, was severely affected. A *Phytophthora* species was isolated from specimens from Glen Innes. Further work is in progress.

Soybean Failure.—Several cases were reported in the Murrumbidgee Irrigation areas. Cause has yet to be determined. It could be a nutritional or physiological problem.

Cowpea Powdery Mildew (Oidium sp.).—This was widespread in a late sown cowpea crop at Moree. Pod development was severely reduced. Epidemic proportions resulted from the showery and humid autumn.

DISEASES OF VEGETABLE CROPS

Potato Diseases

Potato Seed Certification.—Records compiled by Division of Plant Industry showed that no crop of potatoes submitted for certification in the tableland areas was rejected because of an excessive content of virus or other diseases for which certification tolerances were laid down.

Crops at Red Range, Ebor-Hernani, and Guyra on the northern tablelands showed some virus leaf roll and blackleg but insufficient to cause rejection.

Crops in the central and southern tablelands submitted for certification showed very high level of freedom from disease. Blackleg was present but slight in a crop at Orange and in a crop at Crookwell.

All crops submitted at Tomalla in the Upper Hunter area were also passed for certification. Some blackleg and purple-top wilt were observed.

Late Blight (Phytophthora infestans).—It continues to be minor in N.S.W.

No advanced Departmental seedlings were tested for immunity to the "O" race of the fungus this year. This type of testing is no longer warranted, because: (a) the disease is very sporadic; (b) the main varieties grown in N.S.W., Sebago and Sequoia, are field resistant; (c) growing of "O" immune varieties could eventually evolve new races of the fungus, to which these varieties would become susceptible.

Common Scab (Streptomyces scabies).—In co-operation with Division of Plant Industry development of scab-resistant varieties is continuing. But in the 1967–68 trial at Orange Agricultural Research Station not enough scab developed for a scab reaction rating of varieties or seedlings.

Rugose Mosaic (Potato Virus X and Potato Virus Y).—Tests were continued to determine the field reaction of a number of advanced Departmental seedlings to aphid infection by Potato Virus Y (PVY). The seedlings were S2881 (Awaba x U.S.D.A. seedling 336–123), S2885 (Awaba x 336–123), S2894 (835a–4 x Awaba x Merrimack), S2901 (Monak x 11–79 x Merrimack) and S2917 (Monak x 11–79 x Merrimack).

Tubers of these were interplanted with PVY-infected tubers of the susceptible Walanga variety. A population of aphid vectors was allowed to build up on these seedlings and on Walanga, and the vectors were transferred from Walanga to the seedlings. No reaction to PVY was shown by any of the seedlings. The testing will be repeated in the new season.

Bacterial Wilt (Pseudomonas solanacearum).—This was of major importance in table potato crops on the northern tablelands. It was in crops at Guyra, Ebor, Hernani, Dorrigo, Comboyne and Meldrum.

Greatest losses were in the Dorrigo-Ebor area. Infection there ranged up to 95 per cent in individual crops. It was in crops totalling about 100 acres. About 9,000 bags were lost through bacterial wilt. In Guyra area, infection in several Sequoia crops averaged about 10 per cent. These crops had been sown with seed from a grower at Guyra who now considers that there was some bacterial wilt in his 1967 crop. This grower had saved seed for six seasons after importing the original from Victoria.

The disease was not recorded on any property where a crop was grown this season for certification.

Although it was not possible to trace exactly the origin of infection in individual crops, a number of factors would have contributed to the seriousness of this disease on the northern tablelands. Among these are the importation of seed potatoes from the north coast and Queensland, use of second-hand bags, spread by contract planting and digging—through contamination of machines and buckets, and the growers' use of infected seed.

Tomato Diseases

Fusarium Wilt (F. oxysporum f. lycopersici) *and Verticilium* Wilt (V. dahliae).—Cultures of *F. oxysporum* f. *lycopersici* were prepared and supplied to the tomato breeder at Yanco Agricultural College and Research Station.

Tests at Division of Science Services, Rydalmere, showed that a number of tomato lines supplied by the tomato breeder at Hawkesbury Agricultural College, containing STEP 186 and Anahu in their parentage were resistant to *Fusarium* wilt, while lines from the cross Kokomo x Rouge de Marmande x Rouge de Marmande showed moderate to high resistance.

The U.S.A. variety Goldset, seed of which had been held at Rydalmere, was found to be highly susceptible to *Fusarium* wilt.

Combined resistance to *Fusarium* wilt and *Verticillium* wilt was shown in three VF lines submitted by the breeder at Yanco Agricultural College and Research Station. Resistance to *Fusarium* wilt was shown by five selections of the variety Long John; Roma; 884 (Yanco Selection) and Uniset. Bones D3, No. 3, and V6512 were resistant to *Verticillium* wilt.

Blossom-End Rot (non parasitic).—In co-operation with Chemistry Branch the effect of various fertilizer treatments, and/or sprays of calcium salts to the growing plant, were investigated.

In the first experiment, unsprayed plants receiving a basic fertilizer application of 600 lb superphosphate/acre, 200 lb sulphate of ammonia/acre and 400 lb sulphate of potash/acre developed 28.57 per cent blossom-end rot affected fruit. Plants receiving, in addition, calcium chloride at 4 and 8 lb/100 gallons at flowering or early fruit set developed 6.73 per cent and 2.50 per cent respectively. Application of calcium nitrate sprays at 8 lb and 12 lb/100 gallons reduced incidence of blossom-end rot to 6.16 per cent and 7.46 per cent respectively. Incidence of blossom-end rot in plots receiving an additional superphosphate application of 5 cwt and 15 cwt/acre was 24.07 per cent and 23.34 per cent respectively. The results of this experiment have yet to be statistically analyzed.

In the second experiment, blossom-end rot incidence in the plants receiving the basic fertilizer treatment was low (5.92 per cent), and incidence in plots receiving the basic treatment and calcium nitrate spray at 8 lb/100 gallons was 3.66 per cent. The addition, to the basic fertilizer treatment, of 250 lb sulphate of ammonia/acre resulted in a 26.23 per cent incidence. These results and the results of chemical analysis of fruit and foliage have yet to be statistically analyzed.

Club Root of Crucifers (Plasmodiophora brassicae)

Co-operative work with the Bathurst District agronomist continued. This is to find satisfactory control of this disease which is widespread on the Macquarie River flats.

Work done in 1966–67 showed that lime applied at ½ ton/acre and/or fungicidal treatment of the roots of the transplants did not give adequate control in this area.

The main 1968 trial has indicated that application of lime at 30 cwt/acre to the soil prior to transplanting, in combination with any of four fungicidal treatments, reduced club root severity and increased the average curd weight of the cauliflowers harvested. Further trials, and with additional fungicides, are in progress.

Mint Rust (Puccinia menthae)

This disease, first recorded in the Sydney metropolitan area and the northern Illawarra in the 1966–67 season, was further recorded during late summer and the autumn of 1968 on spearmint (*Mentha spicata*) at Kyogle, north coast and at Springwood, central tablelands.

All clones of *M. spicata* obtained from the metropolitan and Illawarra areas and from the central and southern tablelands are susceptible to the locally occurring strain or strains of the fungus.

Asparagus Decline and Replant Problem, Gundagai

Yield from a block of the *Fusarium*-tolerant strain of Mary Washington asparagus planted in old asparagus ground in 1963 was again compared with yield of comparable plantings of the susceptible 500W strain and with yield of a 20-years-old 500W stand. All three were harvested in late spring and early summer of 1967. The yield figures were: *Fusarium*-tolerant line, 5,654 lb/acre; 500W strain, 4,387 lb/acre; and 20-year-old stand, 2,257 lb/acre.

All future plantings or replantings of asparagus at Gundagai will be the *Fusarium*-tolerant U.C.66 and U.C.72 strains. Seed of these are now commercially available from California. These plantings will be supplemented with seed from plants of the *Fusarium*-tolerant strain produced in a selected seedling block at Gundagai. Agronomically, promising plants from the original introduction of Fusarium-tolerant seed have been selected.

Glasshouse testing continued, of seedlings from seed produced by plants of 500W surviving in a replanted block. Twenty pound of this seed was planted in glasshouse soil artificially inoculated with isolates of *Fusarium oxysporum* f. *moniliforme* and *F. moniliforme* var. *subglutinans* had from infected asparagus plants. Three of the resultant seedlings were retained for further testing, as they did not show sign of *Fusarium* attack. Of these three, one has been retained for further testing.

Ten seedlings from previous seed collections not showing Fusarium susceptibility were grown at Rydalmere and seed has been harvested from a single female plant. This will be used for further testing, towards establishing from locally-grown seed a line of 500W asparagus tolerant to *Fusarium*.

Diseases of Beans and Peas

Bean Seed Certification Scheme.—Records compiled by Division of Plant Industry indicated a total of 32 acres, in four crops submitted for certification. All crops submitted were passed for certification.

Virus Diseases of Peas and Beans.—In the 1966-67 season a virus disease resembling subterranean clover stunt virus had caused widespread losses in pea and bean crops. In the 1967–68 season this disease was not recorded in peas, either in commercial crops *or* a trial at Orange Agricultural Research Station to determine reaction of several pea varieties and breeding lines from New Zealand. The lack of incidence was associated with severe drought in the Western region. Isolated incidences of the disease occurred in coastal bean crops.

French Bean Halo Blight (Pseudomonas phaseolicola).—Interest in halo blight has increased following seed crop failures and the introduction of seed from the U.S.A. where outbreaks of this disease have been widespread.

Of eleven isolates of *P. phaseolicola* collected in N.S.W., ten were found to be race 1 and one was determined as race 2 when inoculated onto Red Mexican U.I. 34. The isolate of race 2 was from stringless beans grown at Dubbo in November, 1967.

'Summer Death" of French Beans.—The disease referred to in previous annual reports as the root rot complex has been renamed "summer death". It has become more important through increased use of susceptible stringless varieties, replacing resistant stringed varieties.

Incidence at Yanco this year under unusually hot dry conditions was lower than in previous year. Losses were considerable in susceptible varieties in Windsor and Gosford districts.

Cause of the disease has yet to be determined. Some features suggest that it may be caused by a virus, possibly leafhopper-transmitted. Reaction of several varieties of beans to summer death in N.S.W. is similar to these varieties' reaction to curly top, a virus disease transmitted by leafhopper in the U.S.A. Neither this virus nor its vector are known in N.S.W.

Resistant or tolerant stringless varieties bred in N.S.W. or introduced from overseas are available but not extensively grown. Though some are agronomically suitable their processing quality compares unfavourably with that of new stringless varieties susceptible to the disease.

Quality of one promising resistant breeding line from the United State Department of Agriculture has still to be evaluated. Introduction of breeding lines from the U.S.A. is continuing.

Diseases of Navy Beans.—Fuscous blight (*Xanthomonas phaseoli* var. *fuscans*) was widespread in many bean crops of the variety Kerman, grown in the Dubbo-Narromine area, but was not detected in crops of Seaway or Sanilac.

Powdery Mildew of Cucurbits (Oidium sp.)

This disease continued to be troublesome in rockmelon crops in the Murrumbidgee Irrigation Area and the Lower Murray district. Two of the advanced breeding lines resistant to powdery mildew and *Fusarium* wilt (*Fusarium oxysporum* f. *melonis*) produced by the Rockmelon Improvement Programme of the Division of Plant Industry have been named and released for seed increase. Glasshouse testing methods for disease resistance worked out in conjunction with the Biology Branch have considerably shortened the time for production of these varieties.

Onion Diseases

Pink Root of Onion.—Considerable losses from a disease resembling pink root (*Pyrenochaeta* sp.) were reported from the Griffith district in December, 1967. The disease had not previously been recorded in N.S.W. Damage it caused last season is thought to have been associated with the unusually dry winter. Use of tolerant varieties is the most satisfactory means of control. Recommendations for introduction of such varieties have been made to Division of Plant Industry.

MUSHROOM CULTURE AND DISEASES

Spawn Quality.—The commercial mushroom industry in N.S.W. continued satisfactorily. Grain spawn supplied by commercial mushroom spawn producers has been generally satisfactory.

One spawn producer incurred losses through bacterial contamination. The bacterium was a non-spore-former, could not withstand 75 deg. C for 10 minutes in broth culture and was possibly *Mycobacterium* sp.

Mushroom Industry Short Course.—A second Mushroom Industry Short Course for the Australian Mushroom Growers Association was held at the Division of Science Services, Rydalmere. It was conducted by Professor L. R. Kneebone, Professor of Applied Mycology at Pennsylvania State University, U.S.A., and a world authority on mushroom culture.

New Strains from U.S.A.—Subsequent to his visit, Professor Kneebone forwarded to the Australian Mushroom Growers Association seven strains of mushroom for possible commercial use in Australian conditions. These strains were: D-26, a golden white; 313, a light cream; 320, a dark cream; 303 and 318, white strains especially for button production; 309 and 310, white strains especially for fresh market.

These strains were tested here for the virus disease "die-back" and found to be free of it. Moreover they produced crops of normal mushrooms when pot-grown in quarantine at Rydalmere.

Grain cultures of the strains have now been released to a member of the Australian Mushroom Growers Association for normal commercial culturing.

Mushroom Diseases.—Generally, diseases did little to reduce mushroom crop production this year. The nematode *Aphelenchoides composticola* was recorded in two localities in Sydney metropolitan area and *A. limberi* was recorded at Niagara Park. Mat mould (*Myceliophthora lutea*) was found on two mushroom farms near Sydney.

CITRUS DISEASES

Phytophthora Root and Collar Rot

Testing Trifoliata Accessions.—Testing of accessions of *Poncirus trifoliata* for their resistance to *Phytophthora* root rot has been completed. All the trifoliata seedlings were uniformly and highly resistant to *P. citrophthora*.

Biology of Root Infection Studied.—In an attempt to produce a glasshouse test for resistance to *Phytophthora* root rot, a test to agree more closely with field results, the biology of *P. citrophthora* and the method of infection of roots had to be studied.

Optimum temperature for growth was 25°C, for sporangium production 25°C, and for zoospore release 15–20°C. Optimum temperature for infection of rough lemon roots was 20–25°C.

Zoospores showed no difference in attraction to susceptible and resistant roots and were chemotactically attracted to wounded areas and to the region of elongation of growing feeder roots. Both resistant and susceptible citrus roots were readily infected in the region of elongation.

The pre-penetration and penetration stages were identical in resistant and susceptible varieties and the resistant character was expressed only in fully differentiated cells.

Paper chromatography studies showed no qualitative differences in the amino acid or sugar content of healthy *Poncirus trifoliata* and rough lemon roots. Amino acid content of rough lemon roots decreased to negligible quantities three weeks after infection by *P. citrophthora.*

Fungicide Screenings.—Effect of the fungicides dexon and difolatan on mycelial growth and sporangium production of *P. citrophthora* in vitro are being studied.

The minimum effective dose (i.e. the lowest concentration giving 100 per cent control) of dexon was 50 p.p.m. A few sporangia were still being produced at 500 p.p.m. difolatan, although sporangium production was retarded at 100 p.p.m. and the mycelium became thin and granular and little growth occurred.

Phytotoxicity of dexon to sweet orange, rough lemon and *P. trifoliata* seedlings and the ability of dexon to control root rot are subject of a current glasshouse experiment.

Citrus Black Spot (*Guignardia citricarpa*)

Mangrove Mountain Spray Experiment.—This spray experiment continued on a block of 29-year-old Valencia orange trees at Mangrove Mountain. Seven promising fungicide schedules were compared with the non-sprayed treatment in a 4-replicated randomized-block layout. Fruit production was satisfactory. Disease development was only moderate.

Spray schedules comprised Bordeaux mixture or copper oxychloride at petal-fall with follow-up by one or two sprays of dithiocarbamate fungicides. All programmes satisfactorily controlled black spot and melanose, but some differences between treatments showed at the harvest in mid-January. Two weak Bordeaux-oil applications (2½–2½–100–¼ oil), followed by a final spray application of zineb (2½ lb/100–¼ oil) gave best control.

The combination programme of Bordeau mixture (5–5–100) with alkyl resin wetting agent at petal-fall, followed by two spray applications of mezineb (antracol 2 lb/100–¼ oil) at 9 and 15 weeks, provided almost equal control of black spot. Moreover this schedule was superior in terms of producing fruit of excellent appearance, rind texture, uniform colour and freedom from rind blemish until late January.

Unlike other combination spray schedules that contained two spray applications of dithiocarbamate fungicides (zineb, maneb, dithane M45), mezineb did not cause any deterioration of internal fruit quality. As in previous seasons, fruit from the trees receiving the Bordeaux-antracol schedule had a higher juice content than fruit from non-sprayed trees.

Economic production of Valencias on the light sandy soils of the Mangrove Mountain area has hinged on development of a spray schedule that would control the black spot and melanose diseases and at the same time produce uniformly attractive and unblemished fruit—with good internal quality late in the season.

The Bordeaux-antracol schedule appears to have provided the answer.

Fungicide Screening.—A number of new fungicides were compared with a weak Bordeaux-oil (2½–2½–100–¼ oil) three-spray schedule in controlling disease incidence on Valencia fruit. Thiabendazole (800 p.p.m.) was applied: (a) as a three-spray schedule, at petal-fall, 6 and 13 weeks; (b) as a single application in May; and (c) in August. There was little development of melanose in unsprayed fruit. None of the thiabendazole programmes provided any control of black spot.

Comparable black spot control was obtained with the weak Bordeaux-oil (2½–2½–100–¼ oil), mancozeb (dithane M–45, 2 lb/100), and cufram (ZMC, 2 lb/100) schedules. Mancozeb caused a marked drop in juice percentage, with considerable granulation and loss of palatability by early January. These disadvantages were not evident in the cufram sprayed fruit. This fungicide deserves further investigation.

Citrus Melanose

Spraying Experiment.—A field experiment on melanose control was initiated this year on a block of 29-year-old Washington navel orange trees at the Horticultural Research Station, Narara. Nine spray treatments, including a control, were compared to determine the efficacy of late winter fungicide applications in controlling melanose infections on fruit in the following spring and summer.

The best measure of control (84 per cent clean) was provided by a schedule of a wettable sulphur spray application (4 lb/100) in late August followed by a Bordeaux mixture (4–4–100–¼ oil) spray at petal fall. The timing of the wetable sulphur application appeared to be important. A mid-July spray in a similar schedule provided only 56 per cent clean fruit. A single Bordeaux spray (6–6–100) at petal-fall produced 80 per cent clean fruit.

Brown Spot of Emperor Mandarin (*Alternaria citri*)

Studies of Protectant Sprays.—At the Horticultural Research Station, Narara, a number of new and experimental fungicides were compared with a copper oxychloride spray programme (1 lb/100 gallons), to prevent leaf and stem infections on young calamondin trees. Spraying commenced in early November with an interval of 3 weeks between spray applications. Each material was applied nine times.

Although brown spot development was not severe, considerable leaf infection did occur in non-treated trees.

Thiabendazole (800 p.p.m.) and the experimental fungicide RH90 (ICIANZ) gave very poor control.

Results were encouraging with three materials: difolatan, 1½ lb /100 gallons; ferbam, 2 lb/100 gallons; and the systemic fungicide 1991 (Du Pont), 2 oz/100 gallons.

Each gave better control than did copper oxychloride. There was some spray damage with the systemic fungicide, and some brown spot developed after spraying ended. Difolatan and ferbam appeared to stimulate growth.

Citrus Stubby Root Disease (*Trichodorus spp.*)

Comparison of di-trapex (a mixture of methyl isothiocyanate and dichloropropane-dichloropropene) with vapam (sodium N-methyl dithiocarbamate) for control of stubby root nematodes in citrus seedbeds was initiated at Narara Horticultural Research Station.

Nematodes were not recovered from treated plots three months after fumigation. Small numbers were found 5 months after fumigation. At 7 months after fumigation, populations as high or higher than those in control plots were present. This effect has been observed in previous trials with vapam and other nematicides.

Plots of silver leaf desmodium, siratro, ladino white clover and cowpea were grown as summer cover crops at Narara to compare their effects on *Trichodorus* population increase.

The largest increase occurred under cowpea and the least under siratro. Increase under white clover was only slightly greater than that under siratro and the clover competed best with early weed growth and provided the quickest ground cover.

The summer cover crops were dug in during March, 1968, and the plots were seeded in April with winter cover crops—oats, cereal rye, ryegrasses and cocksfoot.

Virus Diseases of Citrus

Greening Virus.—The citrus survey for greening continued. Suspect trees are being indexed in the glasshouse and at Narara Horticultural Research Station. Some symptoms have been produced in the glasshouse and there are some suspected transmission cases.

Citrus bark extracts are being analysed for the gentisic glucoside reported to occur in greening affected material. This is in conjunction with Dr A. Feldman of Florida. The gentisic glucoside has been identified by him in only three trees: a suspect tree; a healthy control tree; and a tree with severe stem pitting. This method of disease identification appears to have only slight utility.

General Indexing of Viruses.—Tatter leaf virus was recorded for the first time in N.S.W. It was in a line of Meyer lemons growing at Narromine. The virus was mechanically transmitted from Rusk citrange to *Chenopodium quinoa* and *Nicotiana glutinosa.*

Infectious variegation virus has been found on two occasions. It was with crinkly leaf virus in Lisbon lemons. This was the first indexing of infectious variegation symptoms in N.S.W.

A virus similar to psorosis B has been detected in some 40 trees at Monak. In mature leaves the symptoms are ringspot and variegation patterns and in the fruit circular spots which become sunken and necrotic. No bark scaling has occurred.

The leaf pattern has been transmitted by grafting to sweet orange, Orlando tangelo, Eureka lemon, sweet lime and rough lemon. Only two sweet orange plants have developed the young leaf symptoms of psorosis A. Cross protection tests are in progress to establish the relationship between this virus and crinkly leaf, concave gum psorosis and various isolates of psorosis A.

Indexing Departmental Mother Trees.—(a) *Psorosis*: Indexing is continuing. No tree positive for psorosis was found this season. (b)*Xyloporosis*: Indexing of mother trees for xyloporosis is continuing, in collaboration with Division of Horticulture.

Grapefruit Stem Pitting.—Observations on protection given by mild strains against natural infection with severe strains under field conditions were continued, in collaboration with Division of Horticulture.

An extensive planting of mild strain propagations at Narara has been inoculated with severe strains of stem pit virus from various parts of the State. The inoculant is freed from other viruses, by aphid transmissions.

Citrus Nutrition Research

At Narara Horticultural Research Station the nutrition trial was continued in collaboration with Chemistry Branch and Division of Horticulture. The influence of various levels of nitrogen, potassium, calcium and magnesium on leaf composition, fruit quality and yield of Valencia oranges is being examined. (See Chemistry Branch section of this report, page 112.)

POME FRUIT DISEASES

Apple Scab (Venturia inaequalis) *Infection Periods.*—At Bilpin in the central tablelands, nine infection periods were recorded by early December, 1967. The most severe was of 88 hours duration between 11th and 15th October at an average temperature of 59°F.

Warning Services for Scab Spraying.—This service was again conducted at Orange and Batlow, in association with Division of Horticulture.

Virus Indexing.—Indexing of pome fruit varieties for virus diseases continued, but on a reduced scale because the officer concerned was overseas for part of the year.

STONE FRUIT DISEASES

Virus Diseases

Murrumbidgee Irrigation Area Epidemic.—Symptoms of virus infection were widespread in M.I.A. peach orchards in the 1967 spring. Trees in many orchards died from what seemed shock reaction to infection, and in other orchards the failure to bear fruit seemed associated with infection. Indexing revealed that the greasy mottle virus and the necrotic ringspot complex of viruses were present.

Virus Indexing of Budwood Sources.—This continued, but on a reduced scale because the officer concerned was overseas for part of the year.

Brown Rot (Sclerotinia fructicola)

Brown Rot Eradicant Tests.—Three mercury formulations were the most effective of the chemicals tested this season. One was effective at lower rates than previously tested, but this needs confirmation over several seasons.

Pre-harvest Protection.—Artificial rain was again used in the assessment of fungicides. The satisfactory method developed ensures results from all tests regardless of prevailing weather.

Two chemicals were found to be superior to current recommendations and one of them, difolatan, will be included in next season's recommendations. The other is an experimental chemical (1-(butylcarbamoyl)-2-benzimidazole carbamic acid, methyl ester). This one is claimed to be systemic, and there was evidence of absorption of the chemical by peach fruits. Control of brown rot was excellent. Further work is planned.

Epidemiology.—Studies of environmental factors in relation to *Sclerotinia fructicola* sporulation and spore dispersal continued. The Agrometeorology Section of the Commonwealth Bureau of Meteorology has assisted by loaning a surface wetness recorder and a wind direction and velocity recorder.

DISEASES OF GRAPEVINES

Downy Mildew (Plasmopara viticola).—Incidence was low for most of the growing season. Severe infections followed late summer rain. Early defoliation occurred in coastal vineyards in cases where the fungicidal protection was inadequate.

In a spray trial at Chipping Norton, with downy mildew late, Bordeaux mixture, dithianon and an experimental fungicide (I.C.I. RH90) showed good persistence. They protected for several months after the last spray and the foliage remained on the vines, while mezineb and dichlofluanid had little persistence and the vines defoliated early.

Copper oxychloride, copper oxychloride-zineb, zineb, maneb, mancozeb, folpet and metiram showed moderate persistence.

Effect of these fungicides on yield and quality was investigated as an adjunct to this trial. No significant differences were revealed by this one years' treatment.

Dead Arm.—Only light infections occurred in Murrumbidgee Irrigation Areas this season, due to the dry conditions at budburst. Sufficient rain to cause infection was not recorded until some weeks after budburst.

In a trial at Griffith spraying at budburst with captan, dithianon or thiabendazole gave very poor control of dead arm. Dinitro-ortho-cresol as a dormant spray gave very poor control.

Investigation of effect of time of application of sodium arsenite revealed no significant differences but an indication that spraying too early could reduce control. Phenyl mercuric chloride was no better than sodium arsenite.

Bunch Stem Dieback.—It was reported from only one County of Cumberland vineyard this season.

A trial at Camden using calcium and magnesium sprays was handicapped by absence of the condition. However, spraying with a mixture of calcium and magnesium chloride or calcium nitrate removed the bloom from the fruit and tended to delay ripening. Thus, these would be unacceptable methods, at least for table grapes.

Chemical analyses of stems of sprayed and unsprayed bunches failed to show any uptake of calcium from the sprays but a slight uptake of the magnesium was indicated.

DISEASES OF TROPICAL FRUITS

Banana Diseases

Leaf Spot and Speckle (Mycosphaerella musicola and M. musae).—Infections were severe in the 1967–68 season in the Richmond and Tweed River areas. At Alstonville and Wollongbar, using misting machines, the Du Pont fungicide 1991 (4 oz a.i./acre), and thiabendazole (2 lb a.i./acre) and a commonly used treatment (2 lb zineb in 2 gallons oil/acre) are being compared. Each provided some control early, but only the zineb in oil has given prolonged control of both leaf spot and speckle.

The harvested fruit was ripened and examined for fruit rots. No effect of the spraying, on development of rots, was observed.

Mango Diseases

Leaf Spot, Twig Dieback and Blossom Blight (Colletotrichum gloeosporioidea).—The fungus caused severe defoliation in late autumn, and failure to set fruit in spring. Infection occurs primarily on very young leaves during autumn. Some control was achieved by difolatan (3 lb/100 gallons) applied fortnightly, while Du Pont 1991 (1½ lb/100 gallon) and thiabendazole (3 lb/100 gallon) were less effective. In earlier trials zineb applied monthly had been ineffective against this disease.

Passionfruit Diseases

Breeding for Resistance to Fusarium Wilt.—In collaboration with Division of Horticulture, breeding continued for resistance to *Fusarium oxysporum* f. *passiflorae*, by combining *Passiflora edulis* f. *flavicarpa* field resistance with the desirable horticultural characters of the black passion fruit *P. edulis.*

The project has been transferred from Kulnura to Narara Horticultural Research Station. Some 600 selfed hybrids (F_5) will be planited out in the 1968 spring.

Brown Spot (Alternaria passiflorae).—In an experiment started at Narara Horticultural Research Station (Somersby Section) seven-spray schedules are being compared with unsprayed controls.

DISEASES OF STRAWBERRIES

Virus Diseases; Heat Therapy.—Heat therapy of strawberry plants continued, but because of the long periods of treatment needed to free some varieties of all virus disease the number of surviving plants has been low.

Further indexing has revealed several plants of the variety Kendall and one plant of the variety Majestic virus-free.

A trial started in 1966, to compare virus-free Kendall with virus infected Kendall, was carried into the second cropping season in 1967. In the second season the increase in yield of virus-free plants, compared with virus infected plants, has not been as great as in the first season.

DISEASES OF ORNAMENTALS

Downy Mildew of Stock (Peronospora parasitica).—This mildew was severe in the metropolitan area. First recorded in N.S.W. in October, 1966, this disease has become widespread.

Careful spraying does give a good measure of control but, in practice, affected seedlings are difficult to cover fungicidally.

An experimental fungicide (pennsalt TD 5056) has shown promise in initial testing and is being further tested.

Rose Powdery Mildew.—This was very severe in autumn, 1968. Currently recommended fungicides were not giving sufficient control. The experimental Du Pont 1991 fungicide was tested and improved the level of control. This fungicide when registered will be in future recommendations.

Chrysanthemum Leaf Nematode.—In autumn, 1968, this was very common. Good control is usual by spraying with systemic insecticides parathion and fenthion. Failure to spray explained much of the incidence.

Azalea Petal Blight (Ovulinia azaleae).—It was less severe than last year. In the continued testing of new fungicides against it an experimental fungicide (daconil) has shown promise.

Conifer Root Rot (Phytophthora cinnamomi).—Testing varieties of ornamental conifers for resistance to this root rot continued. Eighteen conifer varieties including most of those previously found resistant or partially resistant and some previously untested varieties are being tested by four isolates of the fungus.

Aerated Steam Treatment of Seed.—Experiments on the heat tolerance of seeds in relation to moisture content are continuing.

Cabbage seed infected with the black leg organizm *Plenodomus lingam* was treated with aerated steam and compared with seed treated in hot water and in a fungicidal solution. None of the treatments eradicated the disease, but aerated-steam showed the best control—with least depression of germination.

NEW PLANT DISEASE RECORDS

The Total.—Over 60 plant diseases new to N.S.W. were recorded.

On Field and Fodder Crops.—The new records include two leaf diseases of species of *Lotus.* One of these, caused by *Ramularia sphaeroidea* Sacc., severely damaged patches of *Lotus major* on alluvial soil in the Lismore district. The other, caused by *Cercospora* sp., spotted and shrivelled the leaves of *L. angustissimus* near Sydney.

Powdery mildew (*Oidium* sp. similar to conidial *Erysiphe polygoni* DC. ex St.-Am) was recorded on two species of *Trifolium* near Sydney. One of these (*T. dubium*) was also found to be infected in glasshouse tests at Yanco.

Citrus Virus Diseases.—Two new records occurred during virus indexing. Tatter leaf virus was recorded from a Meyer lemon growing at Narromine and a virus similar to psorosis B was detected in several orange trees in an orchard at Monak.

On Weeds and Native Plants.—Several diseases of weeds and native plants comprised new records for N.S.W.

THE BIOLOGY BRANCH HERBARIUM (DAR)

Over 21,000 *Specimens.*—Over 2,000 specimens were added, increasing the total to over 21,000 specimens in the Herbarium. The majority were plant parasitic fungi from N.S.W. and other parts of Australia. A large collection was received from the University of Turku in Finland.

Host, Parasite, and Geographic Indices.—Helped by the Department's Automatic Data Processing Section a start was made on a programme to prepare comprehensive host, parasite, and geographic indices for the specimen collection. A preliminary working plan has been drawn up for development in the coming year. As well as providing indices to the Herbarium, this work will allow recall of specimen information under a wide range of categories.

Specimen Loans and Donations.—These were made to several institutions during the year.

The Check List of Plant Diseases.—Preparation of manuscript of the Check List of Plant Diseases in New South Wales for cereals, grasses, and field and fodder crops continued.

Problems have been encountered concerning validity of some earlier records and the identity of several fungi. Towards solution, attempts have been made to trace the original specimens. Comparison of several N.S.W. specimens with authentic specimens borrowed from overseas Herbaria has continued, and hundreds of N.S.W. collections have been examined.

Systematic work continued on several groups. Particular attention has been given to an ergot-like fungus which occurs on several grasses in southern N.S.W., to a smut disease of ryegrass, and to rusts of Compositae.

PARASITIC NEMATODES

The Nematology Collection.—Accessions in the Nematology Collection increased from 389 to 470.

Anguina sp.—This was found in seed of Kentucky blue grass (*Poa pratensis*) imported from America. Dormant larvae were present in galls amongst the seed. Positive identification was handicapped because adults were lacking.

The only species of *Anguina* known to attack *Poa pratensis* is *A. agrostis*, the bentgrass nematode.

Aphelenchoides composticola.—This common pest of cultivated mushroom was recovered from soil at Leeton and Narara. Contrary to previous experience, this year it was not recovered from mushroom beds.

Aphelenchoides fragariae.—It was in *Bergenia ligulata* leaf tissue, from Pennant Hills. This plant has been recorded previously as a host of *A. fragariae* (Anon. (1967) Agric. Gaz. N.S.W. **68**, 41–43).

Species of *Aphelenchoides* that could not be classified were found in soils at Bukkulla and Lake Wyangan, and in *Anemone japonica* leaves.

Ditylenchus myceliophagus.—This pest of cultivated mushroom was recovered from soil from Rydalmere.

Helicotylenchus dihystera.—It occurred in soil from a bowling green at Liverpool.

Heterodera avenae.—This cereal cyst nematode was recorded in N.S.W. for the first time; on a wheat farm at Koraleigh near the Murray River, during a survey made with officers of the Victorian Department of Agriculture. Measurements of eggs, larvae, and cysts were well within the ranges reported for *H. avenae* and the cyst cone structure was typical.

Heterodera cacti.—This cyst-forming nematode, recorded for the first time in N.S.W. last year, was transferred to an ornamental cactus (*Mammillaria erythrosperma*). It produced mature cysts on this plant.

Bodies Falsely Resembling Cysts of Heterodera *spp.*—Bodies especially but falsely resembling cysts of *H. rostochiensis*, a serious potato pest not recorded in Australia, were found in soil from Coleambally, Lake Wyangan, Rydalmere, and Narara. Potato and tomato plants grown in the soils remained free of nematode infestation.

The bodies proved to be spores of the *Endogone* group of fungi. These are very widespread in N.S.W.

Root Knot Nematodes (Meloidogyne spp.).—These were found on 26 different hosts and from many parts of the State. Eleven of the host records were new for N.S.W. *M. arenaria* was intercepted on plants of *Ficus decora* imported from New Zealand. Tomato, potato, parsnip, carrot, grape, peach, and white clover were among the crops on which root knot nematodes were found.

Root Lesion Nematodes (Pratylenchus spp.).—These were found in some soil samples collected whilst surveying wheat crops for *H. avenae*. The following species were identified: *P. brachyurus*, *P. coffeae*, and *P. zeae*.

Specimens of *Tylenchorhynchus acti* were also collected during this survey. Several species of *Pratylenchus*, including *P. zeae*, and *Tylenchorhynchus* are known to be wheat parasites.

Grape Survey (*for* Xiphinema index).—Large samples of soil from vineyards at Pokolbin, Chipping Norton, Orchard Hills, and Camden were examined in efforts to detect *Xiphinema index*, the vector of fanleaf disease of grapes. The vector was not found. Most samples contained small numbers of *X. americanum*.

Xiphinema monohysterum.—This species had been described in 1965 from specimens collected from a vineyard at Balldale, New South Wales. This year it was recovered from soil around the roots of a fig tree at Blacktown. It has also been found under sugar cane at Broadwater, New South Wales.

Biology Branch—Bacteriology Section

DAIRY BACTERIOLOGY

Seminars, Conferences, Lecture Courses, etc.

Bacteriology Section was represented at the Australian Dairy Produce Board Research Seminar in Brisbane, the Dairy Factory Managers and Secretaries Annual Conference, and in a committee of the Standards Association of Australia (S.A.A. Committee DS/3—Bacteriological Standards). The Section also provided the Biology and Microbiology course for Food and Dairy Technology diploma students at Hawkesbury Agricultural College, and lectures and demonstrations on dairy product quality at in-service schools for Departmental officers and dairy factory operatives.

The Regional office established at Lismore last year is at present unstaffed, through transfer of the previous bacteriologist to the Public Health Department.

Starter Cultures

Supply of starter cultures for cheese, yoghurt, and other cultured milk products to the dairy industry continued. This year 1,962 starter cultures were supplied; about 300 more than last year's total.

Standards of propagating and handling starter cultures in factories are improving, but many factories have not yet been able to install necessary modern laboratory facilities.

Butter Quality

Manufactured Bulk Butter (*56 lb boxes*).—Biological analyses of the consignments from country factories to the Central Grading Floors in Sydney, Granville, and Newcastle, were carried out during the main producing months from September to April. A total of 1,277 samples were analyzed for five different microbiological counts.

The results, with brief comments on possible sources of contamination and with recommendations for improvement, were sent through the Division of Dairying to the District dairy officers and factory managers.

Overall quality of the bulk butter has risen markedly since the last survey. It is now the most satisfactory since inception of the survey 11 years ago.

Retail Print Butter in Country Areas.—A survey of the biological quality involved 77 samples. Samples purchased in different country centres by District dairy officers were sent to the butter graders of the Division of Dairying for organoleptic evaluation as well as to the Bacteriology Section for microbiological analysis.

This type of survey is designed to assist processors, distributors and retailers of butter to maintain butter quality until the product reaches the consumer.

Butter Processing Plants.—Several surveys were done. Samples to be microbiologically analysed were taken from each stage of the processing.

As far as possible, one sample was followed through each mechanical operation. Results of analyses on these samples indicate points whereat improvements could be made, in cleaning and sterilizing of equipment and in the hygiene of factory personnel.

Cheese Biological Quality

Bacteriological analyses of cheese produced in N.S.W. continued. Cheese samples taken by the District dairy officers once a month are analysed for coliform and staphylococcal contamination.

Overall cheese quality has declined since the last survey. The staphylococcal counts are quite high.

District dairy officers use this information to advise factory managers on sources of contamination and methods for their elimination. Where the quality was consistently poor, officers from the Bacteriology Section have visited the respective factory and advised the staff on improved production methods and hygiene.

Cheese quality will have to improve during the next year to meet export regulations.

Antibiotics in Dairy Produce

Reports from dairy farmers, veterinarians and District dairy officers on the very long excretion times of certain high potency antibiotic preparations used for intramammary mastitis treatment have led to a number of experiments on excretion times.

Experiments using penicillin, erythromycin and nitrofuran preparations common in mastitis treatment, were conducted in conjunction with the Glenfield Veterinary Research Station. Varied results were obtained. Some agreed with the manufacturer's claim; others did not.

These results have been passed on to District dairy officers and veterinary officers to aid in advising dairy farmers of times for withholding milk from the supply after treatment with antibiotics.

The work will be continued through the next year, as there are 45 registered antibiotic preparations on the market for mastitis treatment. These will be given a priority order.

Several experiments have also been carried out on preparations for use in footrot treatment, and some contamination of the milk was found. The N.S.W. Milk Board was advised of the results and the information has been incorporated into Board recommendations.

Requests regularly for *Streptococcus thermophilus* (TSI) and *Sarcina lutea* ATCC 9341 cultures, for use in antibiotic detection, indicate factories' active interest in ensuring that their suppliers' milk is antibiotic free.

Other Services.—Biological defects in food products were investigated on behalf of commercial firms. Yoghurt, goats milk, continental cheeses and mastitic milk samples were among the commodities analysed.

SOIL BACTERIOLOGY

The Clover Nodule Bacteria from Pastures in South-eastern Australia

The effectiveness survey comprising systematic examination of the symbiotic status of subterranean clover pastures in different regions in south-eastern Australia is continuing.

Isolates are made from plants collected in the field and are tested for effectiveness by inoculating subterranean clover plants, growing these under optimal conditions, and then comparing nitrogen fixation and dry weight production with a standard strain. At time of sampling, detailed site histories are taken into consideration and noted. The sites are chosen to cover different periods of establishment, superphosphate application, and whether the seed was inoculated at sowing.

The isolates tested have shown remarkable variation in effectiveness. Apart from expected and large differences between geographical areas, effectiveness has varied between isolates collected at a particular site, between sites in the same paddock, and between paddocks.

There also seems to be no relation between the effectiveness of the isolates from a paddock and the age of the pasture in that paddock, the amount of superphosphate applied to it, and whether the seed was inoculated at sowing.

The only factors which may be related to effectiveness are pH, natural populations of *Rhizobium*, and the presence of white clover. Low pH, high natural populations of *Rhizobium*, and appreciable quantities of white clover seem to be coupled with low effectiveness.

Further work in establishing these and other relationships will have a bearing on recommendations for commercial sowings.

Nodulation Competition Between Strains of Rhizobium trifolii

It is well known that effectiveness of strains of *R. trifolii* varies, depending upon strain and host.

To ensure that the best available strain nodulates the host, clover seed is inoculated with a desirable strain just before sowing. In soil containing natural populations of *Rhizobium* of different effectiveness, the inoculated strain has to compete with these natural strains for nodulation.

Earlier work showed that effective strains in preference to ineffective or partially effective strains nodulate the host, and continue to do so even though the ineffective strain has an enormous numerical advantage. Work to determine the site and nature of this process has continued.

So far it appears that the host is responsible for selecting the strains that nodulate it, rather than the strains themselves determine the success of nodulation.

Sterilization of Field Soil to Remove R. trifolii

To enable field studies on nodulation without the complications of naturally occurring *Rhizobium*, an effort has been made to find methods to reduce the latters' numbers in field soil.

An area of soil was fumigated with methyl bromide 3 lb/100 sq ft), and the number of *R. trifolii* in the soil was estimated at intervals thereafter.

From an initial population of 86,000 per gram of soil, numbers fell to an undetectable level after fumigation. *R. trifolii* was not detectable even three months later.

Rhizobium Establishment Trial, Condobolin

In the second season of a trial to determine the survival of rhizobia inoculum in the soil between seasons, more than 2,000 isolations of rhizobia were made from three different host legumes.

All of these isolates have been serologically typed and the results are being statistically analysed.

Survival of Rhizobia in Sterile Peat

Work on different methods of sterilization is continuing. Use of gamma radiation is being studied in detail.

Survival curves of strain TAI in sterile and unsterile peat are being determined. Initial multiplication of the rhizobia after inoculation into the peat is counted daily. This study will continue, to obtain long-term survival numbers.

Effects of high and low vegemite levels in broth, on subsequent survival in peat, were determined. This study also will continue, to obtain survival figures over 12 months. Strains TAI and WU290 were inoculated into sterile and unsterile peat. The results are being statistically analysed.

Testing Commercial Legume Inoculants

One hundred and ninety-seven packets of peat inoculant purchased in country retail centres were tested. The 1967–68 survey was extended to include inoculants used on legumes other than cowpea, clover, and lucerne. Results for cowpea inoculants were particularly pleasing; 82 per cent, as against 7 per cent in 1966–67, were graded as excellent. There was no failure. This is attributed to the use of sterile peat.

All *Desmodium* inoculants tested were excellent quality. However, 50 per cent of the *Lotononis* and 66 per cent of the *Lotus* inoculants failed to meet the U-D.A.L.S. standards.

One hundred and fifty inoculants for use on temperate species were tested. The host groups tested were clover, lucerne, pea and vetch. Ten per cent of the clover TAI inoculants, 80 per cent of Marrar clover inoculants, and 15 per cent of the lucerne inoculants failed to meet the U-D.A.L.S. standards.

Entomology Branch

GENERAL

Acting Chief and Acting Deputy Chief Entomologists

Chief Entomologist Mr G. Pasfield is on recreation and extended leave from 8th April to 18th October, 1968. Dr G. J. Shanahan has been appointed Acting Chief and Mr J. G. Gellatley Acting Deputy Chief Entomologist for this period.

Overseas Studies/Investigations

Mr N. C. Lloyd returned in September, 1967, from an overseas study tour during which he visited entomological research institutions in Europe, Canada, U.S.A. and New Zealand. Developments in integrated control of pome fruit pests were investigated in particular.

Dr G. J. Shanahan returned in October, 1967, from an enquiry into developments in insecticide resistance in Europe, United Kingdom, Canada and U.S.A. He sought information of possible benefit towards the solution of tolerance and resistance problems with the sheep blowfly.

Entomologist for Amnemus Ecological Studies

An entomologist was appointed in October, 1967, for ecological studies on amnemus weevils. He is located at the Agricultural Research Station, Wollongbar.

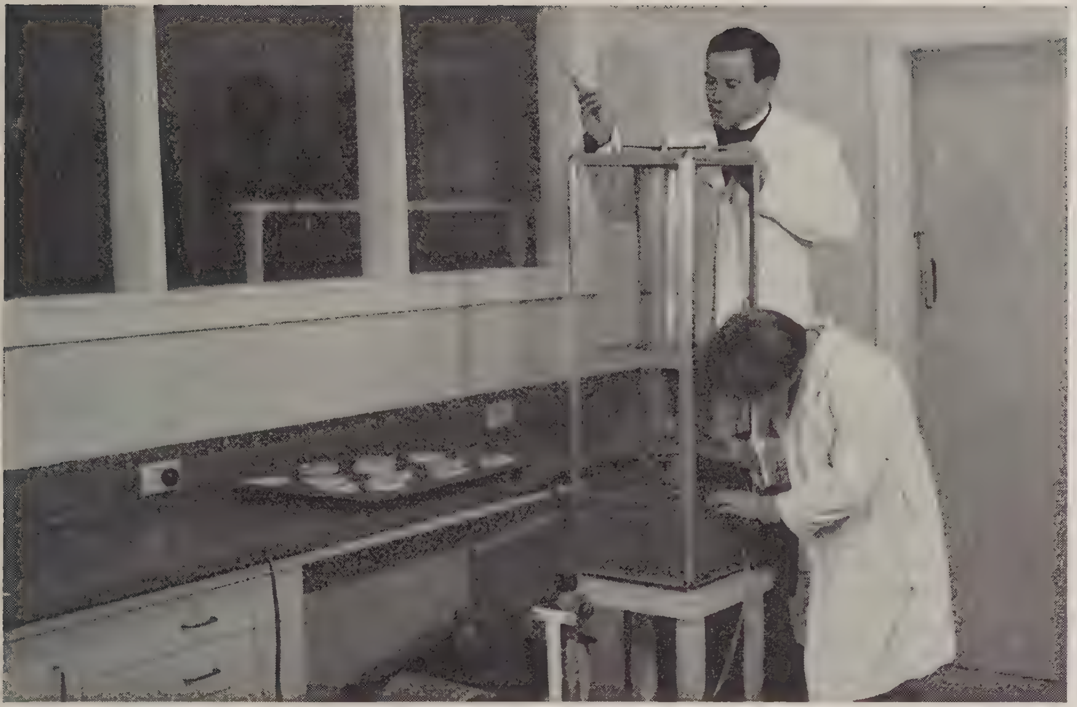
PASTURE AND FIELD CROP PESTS

Australian Plague Locust

Spring Activity, 1967.—The main centre of locust (*Chortoicetes terminifera*) activity continued in the area bound by the towns of Ungarie, Yalgogrin, Mirrool, Barmedman, West Wyalong, Marsden and Burcher, and comprised the eastern section of the area infested by swarms in the previous season. Large hatchings occurred in October, 1967, and were followed by heavy flights briefly in late November. These extended slightly the infested area, particularly towards Lake Cowal and Quandialla.

Extereme drought conditions commenced in November and by mid-December swarms dispersed. Locusts showed signs of moisture stress and high mortalities occurred. Very few locusts matured to lay eggs and there was no significant second summer generation. This represented the end of a serious outbreak cycle which had commenced in autumn 1966.

Further north in the Peak Hill area numerous bands of locusts were recorded in October and produced loose flights of adults in November. These tended to move south, but there was little expansion of the infested area before drought conditions caused heavy mortalities.



Testing Spider Mites' Resistance

Because of field evidence, the seeming resistance of spider mites (tetranychids) to various insecticides is being studied by means of the Potter Tower in the Entomology Branch

To Grow Micro-organizms

The activity of plant pathologists and bacteriologists in the Biology Branch is reflected by this technician's rate of production of tubed media for growth of micro-organizms being studied there

In the major outbreak areas of the central-west, large populations of overwintering nymphs were observed in July and August, 1967, indicating that they are an important feature of the locust's life cycle in some years. By September they were adult and had formed loose aggregations in some localities. Egg laying occurred in late September and early October. Hatchings of the main first generation occurred in early October, and non-swarming populations were sufficient to cause concern for later in the season. However, drought conditions caused heavy mortalities in December and only a very small proportion reached maturity and laid eggs.

Widespread, good rains in the central-west in early January, 1968, were followed by heavy growth of pasture. Locust numbers were low in January but increased rapidly from February to May, and large areas supported populations of the order of 0.1–0.5 per square yard. Small egg-laying swarmlets were observed in some localities. During this period all stages of locusts were present, from hatching to mature adults. Egg laying was widespread.

The population over the whole area was essentially non-swarming but represented a striking recovery from the low numbers in December and was the highest recorded since detailed surveying commenced in 1965.

No Aerial Control Experiments.—Planned aerial control experiments to test aspects of ultra-low volume aerial application of insecticide were not possible. This was because of the sudden collapse of locust infestations in all parts of the State in December.

Complete Outbreak Cycle Recorded.—Special attempts were made during the outbreak in the Lake Cargelligo-Wyalong area to record in detail the course of the outbreak. This was continued until January, 1968, when the outbreak was considered to have collapsed. It is believed to be the only detailed record available, of a complete outbreak cycle (March, 1966/December, 1967) in which swarm flights and locust behaviour are particularly well documented.

Study of Phase Changes.—The study of phase changes in locusts continued. A number of new series was collected during the season. As soon as sufficient series showing extreme features such as long histories of swarming, under varying temperatures and moisture conditions and, alternatively, long histories in a low density population, are obtained and measured, a preliminary analysis will commence.

Many other locust series showing features in between these extremes have been collected and measured. It is already apparent that phase status in terms of body measurements is closely related to the history and behaviour of any particular locust series.

Locust Information Service.—Considerable time was devoted to the locust information service. This service provided through the locust patrol officer detailed quantitative surveys of each locust generation in the central-west and changes in numbers of locusts from generation to generation.

An aerial survey was made of far western districts in March, 1968. It established that a fixed winged aircarft could be very usefully employed for survey of these remote areas, not only to determine the most suitable route for a more detailed ground survey, but also to obtain directly much valuable information on locust activity.

Land-use Survey.—This has been commenced in the central-west by estimating the proportion of land used for crops, pastures, timber, etc., in traverses by vehicle along link roads and tracks. The data are being analysed to give proportions of the outbreak area suitable for locust breeding.

When completed, this will allow locust numbers to be expressed as a single figure (e.g. so many millions) for a particular region instead of a series of density per 1,000 square yards figures. The single estimate will be more meaningful and more convenient for comparison between locust generations.

Small Plague Grasshopper

Unusually widespread and dense infestations of *Austroicetes cruciata* occurred during the latter part of 1967. Hatchings took place in August and September, 1967 over a large area in the south-west of the State. This is the normal distribution of the insect, but very heavy infestations were also observed as far north as Coonamble. Parts of the Dubbo district were badly affected.

The widespread infestations were related to the very dry conditions prevailing over most of N.S.W. in 1966 and 1967: Similar densities have not been seen for many years.

Wingless Grasshopper

Very severe infestations of *Phaulacridium vittatum* occurred in all the tableland areas, especially in an area between Oberon and Goulburn, during November and December, 1967.

Grasshopper damage allied with prevailing drought conditions reduced pastures to very low levels by the end of December. Concentrations of grasshoppers were seen marching along roads and tracks in search of food.

Excellent general rains occurred in early January and populations of wingless grasshopper were drastically reduced so that only sporadic, scattered reports of infestation were received for the remainder of the year.

Clover Root Weevil

The Incidence.—In north coastal areas clover and sub-tropical legume pastures were only lightly infested with *Amnemus* larvae in winter, despite high adult populations in the preceding generation. Soils were excessively wet in March and June of 1967 after major floods and the highest June rainfall on record. Many larvae are believed to have been killed.

Adult numbers were low until February, 1968, and even then foliage damage was masked by prolific growth. Significant egg laying occurred from February to April in the petioles of clover, the rotting runners of sub-tropical legumes and the hollow seed stalks of grasses. Larvae were numerous in some pastures from April to June and damaged the roots of *Desmodium* spp. and *Glycine javanica*.

Control Principles Summarized.—With a ban on dieldrin in pastures except as an establishment and sub-surface treatment, because of residue problems, control investigations are directed at determining the length of effectiveness of pre-sowing dieldrin and heptachlor treatments, and sub-surface treatments with dieldrin; finding effective alternatives with non-residue producing materials, and assessing legumes for resistance to clover root weevil.

Experiments on Residual Insecticidal Effects.—Investigations into the residual effectiveness of dieldrin at rates from 0.5 to 4 lb active ingredient (a.i)/acre, thoroughly incorporated into the soil before sowing sub-tropical legumes, continued in three long-term field experiments.

In a *Desmodium intortum*/*Setaria* pasture, less than 2 per cent of *D. intortum* roots were damaged in control plots in the first year of the experiment and no damage was recorded in plots treated with dieldrin at 0.5, 1 or 2 lb dieldrin/acre.

In the second experiment, in a *Glycine javanica*/kikuyu grass pasture, 23 per cent of *Glycine* roots were damaged in plots treated with dieldrin at 1 lb/acre, 23 per cent in the 2 lb plots and 18 per cent in the 4 lb plots in the first year of the experiment.

In the third experiment in a *D. intortum*/Setaria pasture, less than 1 per cent of *Desmodium* roots were damaged in plots treated with dieldrin at 2 lb/acre, nil in the 4 lb plots and 29 per cent in control plots in the second year of the experiment.

Experiment with Pre-sowing Treatment.—A fourth experiment involves the pre-sowing treatment of soils with insecticides. It was initiated this year. In it dieldrin and heptachlor each at 1 lb/acre rate are being assessed in a *G. javancia*/Siratro pasture. Effectiveness of the treatments against *Amnemus* has not yet been assessed, but neither insecticide affected germination or nodulation of the plants.

Spring Insecticide Application, by Sod-seeder.—An experiment was started during the year to assess the effectiveness of dieldrin applied in spring by sod-seeder. There could be advantages over a mid-summer treatment in terms of residues and ease of application. The experiment is located in a *G. javanica*/kikuyu grass pasture and results are not yet available.

Screening Insecticides.—Laboratory and field screening of insecticides for the surface treatment of established pastures continued, with emphasis on non-residue producing materials.

Six insecticides were laboratory tested at the rate of 4 lb/acre against advanced *Amnemus* larvae. The insecticides are experimental materials C8514, Sch. 36103 and S4400, arprocarb, disulfoton and fensulphothion. The arprocarb was effective on a short- and long-term basis, but the other insecticides all failed in residual tests.

A field experiment wherein chlorfenvinphos, dursban and endosulphan were under test was inconclusive because of low *Amnemus* larval numbers. It is now being repeated, with the addition of arprocarb and declorone. The latter gave promise in a field experiment 2 years ago.

Screening Legumes for Resistance.—Screening of a range of temperate and sub-tropical legumes for resistance to *Amnemus,* at five sites in the Richmond-Tweed area, gave indeterminate results at the first annual winter assessment. Larval numbers were low at each of the five sites and root damage was negligible.

Resistance both to *Amnemus* adults and larvae is now being further examined in laboratory experiments, using a range of legumes.

Biological Study of Amnemus Weevils.—A study of the biology of *A. superciliaris,* which occurs chiefly in the drier, western parts of the far north coast, commenced at Wollongbar. Laboratory tests as a preliminary to an ecological study of *Amnemus* were also initiated, to determine the effects of temperature on some stages of *A. quadrituberculatus.*

Sub-Tropical Pasture Legume Pest Survey

A survey of the insects occurring on the main species of sub-tropical legumes continued on the north coast. Clover root weevil (*Amnemus spp.*) was not so damaging as in previous seasons. Cutworms (*Agrotis* sp.) severely damaged seedling *Dolichos lablab* and *Desmodium* sp. in the Bangalow-Newrybar district in November, necessitating the resowing of some crops. Adult white-fringed weevil (*Graphognathus leucoloma*) defoliated parts of some *Desmodium* pastures in the Tweed and Kyogle districts in January and February. Larvae of the native budworm (*Heliothis punctigera*) severely damaged the shoots of a five-acre *Lotononis bainesii* pasture at Kyogle in October. Minor swarms of the red-shouldered leaf beetle (*Monolepta australis*) defoliated small sections of *Desmodium* pastures in the Tweed, Brunswick and Richmond districts in February. Tarsonemid mites grossly infested foliage of *Desmodium uncinatum* in isolated pastures in the Tweed district in May, and are believed responsible for severe scorching of the leaves and partial defoliation of plants under dry conditions.

Armyworms and Cutworms, Noctuidae

Outbreaks were recorded in coastal, tableland and slopes districts, but because of dry conditions in the first half of the year were restricted to localized areas.

Incidence of Common Armyworm.—Most of the outbreaks involved the common armyworm (*Pseudaletia convecta*). In spring, outbreaks of this species occurred in maize and in pastures on the south and central coasts, and in summer in seed and cereal crops on the south coast and tablelands. Widespread outbreaks occurred in pastures on the north and central coasts in late summer and autumn following heavy protracted rain.

Incidence of Southern Armyworm.—Isolated infestations of the southern armyworm (*Persectania ewingii*) occurred in *Phalaris* seed crops and in oats on the central and southern tablelands in early summer.

Detailed Studies of Common Armyworm.—A study of the effect of temperature on the various stages of *P. convecta* was continued. Eggs tolerated a temperature range of 10–30° C, taking 24.0 to 3.5 days to hatch; when pupae were exposed to temperatures of 15–30° C adults emerged in 35.7 to 8.7 days. Larvae survived all temperatures (10° to 35° C) although at temperatures above 32° C mortality increased rapidly. Time taken to complete the first instar ranged from 13.8 days at 10° C to 2.2 days at 35° C.

Daily light trappings of *P. convecta* at Rydalmere showed two major flights. The first was in October. The second, greater in magnitude, was in April/May. These moth flights coincide with the usual outbreak periods in the Sydney district.

Studies have revealed that an average of 17.7 per cent of the larval mortalities following an outbreak are from parasitism, while 60.7 per cent are from viral diseases. Generally 9.6 per cent of the population survives to start the next generation.

Thirty-one parasites have been observed and recorded as attacking *P. convecta,* comprising 13 Hymenoptera and 18 Diptera. Eight predators have been observed.

Relationship between colour and density of larvae showed that, under field conditions, increasing density tends to increase the proportion of dark-coloured individuals. Colours ranged from cream through green and brown to black. The latter colour was only achieved under heavy plague conditions. Under plague conditions all caterpillars were approximately the same age.

Host preference studies with ovipositing females showed that adults oviposit on wheat, oats, maize, barley and sudan grass, but maize was highly preferred and sudan grass was least preferred. Ninety per cent of all egg batches were laid on the terminal or basal leaf, with a distinct preference for the terminal leaf. Newly-hatched larvae followed a similar pattern of distribution on the plant, preferring either the terminal or basal leaf.

An instecticide trial was established at St Marys during 12–19th February to find alternatives to DDT for *P. convecta* control. The materials were fenitrothion at ½ lb and 1 lb a.i./acre, dursban 1 lb a.i./acre, carbaryl 1 lb a.i./acre, diazion ¾ lb a.i./acre, and methidathion ½ lb a.i./acre; applied by "lo-vol" boom spray.

A rapidly declining population restricted observations to a 24-hours post-treatment count. All treatments other than fenitrothion a ½ lb a.i./acre gave over 90 per cent control.

Blue Oat Mite

Incidence.—After extremely late hatching of oversummering eggs of the blue oat mite (*Penthaleus major*) at the end of the 1966–67 season, it was July, 1967, before sufficient rain fell to enable the population to increase. Isolated reports of damage were received from many areas of the State, but generally infestations were much lighter than usual. Adequate rain was received during the season to allow the oversummering eggs to hatch in autumn. Populations have since been increasing rapidly.

Field Studies.—These showed that under the weather conditions of 1967 *P. major* passed through two generations. The second generation adults died with the onset of the warm weather in November.

Temperature Studies.—Studies on winter eggs of *P. major* showed that temperature increases reduce egg viability. At 32.0 and 37.5° C 45.6 per cent and 86.25 per cent of eggs were non-viable after 10 days.

Adults were killed at temperatures above 30.0° C within 12 hours. With decreasing temperature, adult longevity increased, daily egg production decreased, and oviposition period increased.

Insecticide Trial.—In a trial established late in the season a new compound, Bayer 5089 at ½ oz a.i./acre, gave excellent control of blue oat mite.

Red-legged Earth Mite

Incidence.—Lateness of the opening autumn rains in 1967 delayed the hatching of oversummering eggs of the red-legged earth mite (*Halotydeus destructor*). Very few reports of activity were received until July. Populations increased rapidly after this. Damage was confined mainly to the central western districts and irrigated areas in the southwest. Mite populations decreased rapidly in mid-spring as temperatures increased.

Temperature Studies.—Temperature studies on adults revealed that *H. destructor* has a narrower temperature range than *P. major. H. destructor* followed a similar pattern to *P. major* between 15.5° and 37.5° C, but temperatures below 15.5° C caused increased mortality and reduced oviposition of *H. destructor.*

Blue Oat Mite/Red-Legged Earth Mite Survey

A survey to establish the distribution of both species was continued. Within areas where both species occurred, red-legged earth mite was usually associated with imroved country, and blue oat mite was the dominant species in unimproved areas.

Seed-Harvesting Ants as Pasture Pests

A Survey.—In late May and early June, 1968, a survey was carried out on the northern and southern tablelands and the northwest and southwest slopes. In the northwest, ants of the genus *Meranoplus* were commonly found in pasture, and accumulations of grass inflorescence material were around their nest holes: this is of interest, because species of *Meranoplus* are known as seed-harvesting pests in Queensland.

The seed-harvesting species seen in the southern half of N.S.W. belong to the genus *Pheidole,* and in the central tablelands these ants are extremely efficient collectors of seeds of improved pasture plants, including *Phalaris tuberosa,* ryegrass and burr medic. They can even remove large legume seeds such as Yarloop subterranean clover.

Tests of Substances Non-insecticidal.—At Bathurst a number of substances not classed as insecticides was tested on grass seed to ascertain their value in repelling ants or otherwise deterring them from carrying off the treated seed. A few of these chemicals were found to have repellent or deterrent properties against *Pheidole*. But the effects were too short-lived for practical purposes. It seemed likely that the search for seed protection by substances other than toxicants might be difficult.

Screening Insecticidal Seed Dressings. In a screening experiment with a range of insecticides as seed-dressings, liquid formulations of DDT, methoxychlor, lindane and baygon were compared with dieldrin. Quantities of seed, variously treated, were placed out on miniature raised plots of bare soil, widely separated through a paddock to lessen interference effects between treatments.

The dieldrin, DDT, lindane and baygon gave a very high degree of protection against ant theft. The methoxychlor treatment, though less effective, was clearly of some benefit. The lindane, DDT, baygon and methoxychlor will be further tested (against dieldrin and untreated controls) on a larger scale, to simulate more closely the conditions of broad-acre sowing.

Lucerne Bud Mite

Since lucerne bud mite (*Aceria medicaginis*) was first recorded in N.S.W. in 1966, it has been recorded from 14 widely separted areas in the State. The mite has always been associated with dwarfed lucerne plants, with gross proliferation of the terminal shoots. Investigations to assess the importance of the pest and to formulate methods of control have commenced.

A spraying trial was commenced at Temora Agricultural Research Station to assess the relationship of the mite and dwarfing of lucerne plants, its importance as a pest of lucerne and to formulate a spraying schedule to control the mite.

Black Beetle

An opportunity was taken to test the effect of applying a drench of dilute emulsion of synergized pyrethrins to lawn-grass turf infested with black beetle (*Heteronychus arator*) in the metropolitan area. The treatment caused adults of this species to come to the surface, where they remained for some hours in a paralytic condition.

Pasture Cockchafer

During January, 1968, adults of *Aphodius tasmaniae* were taken at a light trap at Rydalmere. Adults of this species were also found at light in Bathurst in January and March. These observations suggest that light trapping may warrant investigation as an adjunct to the detection and control of this important pest.

Pruinose Scarab

Adults of pruinose scarab (*Sericesthis germinata*) came to artificial light in the Sydney metropolitan area in November and December, 1967.

Cotton Insects

Onion Thrips (Thrips tabaci).—Seedling pests were of little importance. Onion thrips (*Thrips tabaci*) caused leaf malformation in late October and November, but seedlings quickly recovered without treatment. A trial at Narrabri Agricultural Research Station with phorate and disulfoton applied in granular formulations into the soil at planting time did not lessen leaf malformation caused by thrips. In three commercial crops similarly treated no benefit was apparent.

Lesser Armyworms (Spodoptera exigua).—These heavily infested a crop grossly overgrown with grassy weeds due to insufficient seed-bed preparation. Cereals and grasses are the preferred food plants of this insect. After eating the grass, the caterpillars attacked and almost defoliated the cotton seedlings. In other cases, the caterpillars invaded crops from grassy headlands but damage was not severe. Pest status of *S. exigua* has been greatly reduced by growers' increasing use of pre-emergence herbicides.

Common Bollworm (Heliothis punctigera).—The season was marked by the low incidence of this main cotton pest. Moth numbers, measured in the light trap from late December to mid-February, main period of attack on cotton, were less than one-tenth those noted for the previous season. Caterpillar attack on squares, flowers, and young bolls was low. Lack of alternative host plants in this very dry early spring restricted build-up.

Cotton Aphid (Aphia gossypii).—The aphid appeared in crops in December, much earlier than normal. Infestations were usually restricted to the edges of crops but colonies continued to develop in some crops until late March. Namoi Cottongrowers' Co-operative by circulars told growers the importance of aphid control and prevention of lint contamination with the aphids' sticky "honey dew" excretions. The latter is involved in a spinning mill problem known as "sticking".

Tobacco Looper (Plusia argentifera).—Cotton leaf damage was considerably less in the previous season. A fungus (*Entomophthora* sp.) infected and killed most of the caterpillars by the end of March. This removed need to apply control measures.

Rough Bollworms (Earias huegeli).—The bollworms were found in buds and bolls in early February and again in mid-March. Since the attacked fruits were too late to reach maturity the damage was not important.

Light trapping, maintained to check on the prevalence of major lepidopterous insects in cotton, yielded an unusually high number of rough bollworm moths in mid-March. About 700 adults were taken in one night.

Spider mite (Tetranychus ludeni).—Most infestations were adequately controlled with one inclusion of an organophosphorus miticide such as demeton-S-methyl, carbophenothion or methyl parathion, with the bollworm sprays. In some crops two applications were needed.

In one crop at Myall Vale, applications of three different miticides—within 20 days—methyl parathion, formothion, and carbophenothion failed to give control. Tests on a sample of mites from this field suggests that resistance may have developed.

Twenty-one miticides were tested in this field in a search for an alternaitve. A non-organophosphorus chemical, chlorophenamidine (Schering 36268) gave a very encouraging result.

Large Stout Wingless Grasshoppers (Perelytrana sp.).—A plague of these invaded a Wee Waa cotton crop from an adjacent ungrazed native pasture. However, they did not penetrate beyond about 10 rows. Plants along outside rows had leaves, stems, and fruits badly chewed but overall damage was insignificant.

In a field trial at Narrabri Agricultural Research Station, plots that were sprayed only three times on a "strategic" schedule (i.e. sprayed only when judged necessary, after detailed insect counts within the crop) yielded over three bales of lint per acre. This was not significantly less than the yield of plots sprayed 10 times on a schedule simulating commercial grower practice.

Soybean Pests

Range.—Seedlings in a "variety x time-of-sowing" trial at Narrabri Agricultural Research Station were infested in December by occasional larvae of the common blue butterfly (*Zizeeria labradus*) and in January by a leaf-mining caterpillar. Neither was important.

Late in April, other trial plots became heavily infested by the spider mite (*Tetranychus lambi*), the first record of this pest in north-western N.S.W. These same plots were also infested by green vegetable bug (*Nezara viridula*).

Insecticidal Field Trial.—A small field trial at Narrabri Agricultural Research Station was to determine if any yield increase could be had by a schedule of insecticidal applications. But no important insect infestation occurred at any stage of growth. Yield from plots sprayed seven times was thus no better than that from plots left unsprayed.

Rape Pests

Range.—Seedlings in a variety trial at Narrabri Agricultural Research Station were lightly infested late in May, 1967, by turnip aphid (*Lipaphis pseudobrassicae*). By mid-June the aphids had disappeared.

Late in June, an occasional larva of cabbage white butterfly (*Pieris rapae*), cabbage moth (*Plutella maculipennis*) and lucerne looper (*Zermizinga indocilisoria*) could be found, but damage was insignificant.

In September, grey cabbage aphids (*Brevicoryne brassicae*) heavily infested the inflorescences of the three earliest varieties to flower. They were controlled by a misting with demeton-S-methyl at 4 oz a.i. per acre. A second misting was needed in mid-October, as the later maturing varieties came into head. This second application also controlled a rather heavy infestation of Rutherglen bug (*Nysius vinitor*) in the seed pods of the variety Pilot.

Safflower Pests

A time of sowing trial at Narrabri Agricultural Research Station became infested in September with the flea beetle (*Longitarsus victoriensis*). DDT spray at 1 lb a.i. per acre gave 100 per cent mortality.

The only other pest was Rutherglen bug. Adults clustered in heads flowering in mid-October, but plots which flowered later did not become infested. Rains in early January caused the ripened seed to shoot in the heads. Thus it was not possible to determine whether yield had been affected by Rutherglen bug infestation.

Grain Sorghum Pests

Some aphid infestation occurred in the Namoi region during March. The grain was at this stage well formed and it is doubted that the infestation had any effect on yield.

Infestation by sorghum midge (*Contarinia sorghicola*) was light in the Gunnedah and Tamworth districts and negligible in the Narrabri-Wee Waa and Moree districts.

FRUIT TREE PESTS

Two-Spotted Mite (*Tetranychus urticae*)

Control Failures Investigated.—At Orange, three cases of poor control on apple were investigated. The possibility of resistance to dicofol was tested by applying dicofol 0.04 per cent a.i. thoroughly by hand. For comparison, neighbouring trees were similarly sprayed with binapacryl 0.05 per cent a.i. and other trees were left unsprayed. The tests indicated that the poor results previously obtained by the growers were due to inadequate spraying methods and not to any resistance to dicofol.

Application Methods Tested.—At Bathurst Agricultural Research Station the efficiency of thorough hand spraying from the ground, automatic dilute airblast spraying, and application by means of an oscillating boom were compared by tests. Dicofol 0.04 per cent a.i. was used as the acaricide and each application method was tested on 15 to 20 medium to large Granny Smith apple trees.

Hand spraying gave excellent results and was considerably superior to the other two application methods. The latter about equalled each other.

Pest Management in Pome Fruit Orchards

Inter-State and CSIRO Project.—This was the second season of a co-operative programme in which four States—New South Wales, Victoria, South Australia, and Tasmania—are collaborating with the CSIRO Division of Entomology. The project is financed on funds from the Australian Apple and Pear Board and the Commonwealth Government.

The study blocks in N.S.W. are at Bathurst and Leeton. The Bathurst block consists of Granny Smith and Jonathan apples; the Leeton block consists of Granny Smith apples, with occasional Jonathans.

The only pesticides applied were ryania to control codling moth, and captan and dinocap respectively to control apple scab and powdery mildew.

The Bathurst Study Block.—Thirty-three per cent of fruits showed deep entries by codling moth (*Cydia pomonella*) despite the heavy schedule of ryania sprays. This schedule involved 10 to 11 applications at intervals varying from 1 to 3 weeks, and at dosages varying from 4.2 to 8.3 lb of 100 per cent powder per 100 gallons dilute. However, the crop was an extremely small one and in a normal crop the damage level would undoubtedly have been much lower.

Other pests to cause fruit damage were, in descending order of severity of infestation: looper caterpillar (*Chlorocylstis* sp.), light brown apple moth (*Epiphyas postvittana*), apple dimpling bug (*Campylomma livida*), San Jose scale (*Quadraspidiotus perniciosus*) and Parlatoria scale (*Parlatoria pittospori*). All of these species were far less damaging than was codling moth.

Two-spotted mite (*Tetranychus urticae*) was adequately controlled by natural enemies, as in the previous season. Conditions very much favoured this pest, yet foliage damage was commercially important on only about 15 per cent of trees and was severe on less than 5 per cent.

Six predators were identified. Of these, a ladybird beetle *Stethorus vagans* and *Scolothrips* sp. were by far the most important. A phytoseiid mite, as yet unidentified, is regarded as of great potential.

Woolly apple aphid (*Eriosoma lanigerum*) was well controlled by its wasp parasite (*Aphelinus mali*) but predators were of negligible importance. The woolly aphid is slowly increasing in the study block but is still not commercially important.

Plague thrips (*Thrips imaginis*) severely damaged the blossoms, but effect on fruit set was difficult to assess. Fruit set was extremely poor even where no thrips damage occurred.

No species other than those mentioned has caused any damage in the study block at Bathurst.

A number of trees were sprayed with superior winter oil 3–100 in early September. There was no evidence that this spray had any ill-effect on spiders, which are useful predators of light brown apple moth, but there was indication that the spray caused some mortality of predatory mites.

The Leeton Study Block.—Codling moth caused deep entries in 57 per cent of fruits. This high incidence was related to a very small crop, amounting to only about 5 per cent of that in previous season, and to the large population of codling moth carried over from the previous season.

The ryania programme designed was inadequate to prevent the small crop's heavy infestation by the numerous first generation caterpillars. A modified ryania programme helped somewhat to reduce damage by the second generation.

San Jose scale increased rapidly during the season. Forty per cent of fruits were infested at harvest and there was dieback on some lateral growth. A granular formulation of temik, watered into the soil around the trees at 0.1 oz a.i. per inch of trunk diameter, gave no control of the scale.

Two-spotted mite did not damage the foliage seriously because its build up was delayed for several weeks by the action of beneficial insects. Populations were at a high level for about three weeks in late January to late February and reached a peak in late February. They declined rapidly in late February and early March due to natural enemies, mainly *Stethorus* sp. and *Scolothrips* sp.

Infestation of fruits and foliage by light brown apple moth was negligible.

Woolly apple aphid was present, but not at troublesome levels. The wasp parasite *Aphelinus mali* was very active.

Apple dimpling bug and fruit caterpillars caused negligible fruit damage.

Queensland Fruit Fly

Heavy Incidence.—Under favourable weather conditions, fruit fly (*Strumeta tryoni*) activity was pronounced in coastal districts through the whole season, extending to tableland areas in summer and autumn.

On the far north coast young passionfruits were attacked throughout the year, and ripe bananas (unharvested in a period of over-production in autumn) were heavily infested.

Early summer fruits along the coast were readily infested after November, and Valencia oranges were commonly stung after January in central coast areas. Through late summer and autumn, infestation of pome and stone fruits was common in County of Cumberland, and heavy in tableland areas at Armidale, Coonabarabran, Bilpin, and Penrose.

In the Murrumbidgee Irrigation Areas and surrounding towns a fruit fly suppression scheme operates; with regular applications of maldison and protein hydrolysate, and grids of male-killer lures. One adult was trapped at Griffith in December and one at Griffith and one at Leeton in March. No larval infestation of fruit was recorded. No fruit fly was detected at Coolamon, Darlington Point, Hay, Hillston or Narrandera.

Survey of Fruit Flies.—A survey of fruit flies continued in the Tweed district.

Male lure traps yielded mainly *Strumeta tryoni* and small numbers of *S. humeralis, S. bryoniae, S. melas, Callantra aequalis* and *Dacus absonifacies*. Single specimens of male *Zeugodacus choristus* were taken from traps at Duranbah in April and Stott's Creek in May; the first records of this species in N.S.W.

Ammonia vanilla lures yielded mainly *S. tryoni, S. cacuminata* and *Dirioxa pornia* and small numbers of *S. humeralis, S. bancroftii, S. melas, S. strigatus, Austrodacus cucumis* and *Afrodacus brunneus*. Catches of *S. tryoni* were high in October, November, January-March, and May; *S. cacuminata* and *D. pornia* in November-January; *S. bryoniae* in October and *S. bancroftii* in January-February.

Male *S. cucuminata* were attracted in large numbers to the opening flowers of Taro (*Colocasia esculenta*) at Murwillumbah in December and to Sandfly Zieria (*Zieria smithii*) at Talarm via Macksville in May. *S. halfordiae* was bred in March from fruit of *Rauwenhoffia leichhardtii* from Mount Warning rain forest.

Apple and Pear Disinfestation.—The U.S.D.A. Division of Plant Quarantine approved cold storage for 14 days at 33°F, or 13 days at 32°F, as disinfestation treatments for apples and pears against *S. tryoni*. This arose from the research at Gosford Laboratory from 1963 to 1965.

Banana Commodity Treatments.—Investigations at Gosford Laboratory established a relation between larval mortality in artificially infested bananas and the ethylene dibromide (EDB) dose for chamber fumigation for 2 hours at 70°F. Very high mortality was demonstrated: five survivors amongst 134,520 eggs and larvae, in bananas fumigated at 14 oz per 1,000 cu ft dose rate.

A survey for susceptibility of bananas to skin injury by EDB fumigation showed that the 15 oz per 1,000 cu ft dose is approximately marginal for causing blemish, and that EDB fumigation delays ethylene-induced ripening.

Analysis of banana pulp for EDB residues showed 10.7 ppm at ½ hour and 7.7 ppm at 4 hours, after 10 oz 70°F chamber fumigation. Hard green bananas retained slightly higher quantities of EDB than did riper fruit.

Preliminary trials with artificially infested bananas dipped in dimethoate 0.03 per cent showed dip times of 10 seconds, 30 seconds, 60 seconds, and 2 minutes to be as effective as the standard 3-minute dip now used for treatment of bananas before entry into the Murrumbidgee Irrigation Areas. Promising alternatives to dimethoate as dip treatments for bananas were naled and trichlorphon.

Oriental Fruit Moth

New Lure Tested.—In a Murrumbidgee Irrigation Area peach orchard test, traps baited with terpinyl acetate caught many more adults of Oriental fruit moth (*Cydia molesta*) than did those baited with syrup lures. This was without increasing the catch of the extraneous species which normally contaminate the syrup lures.

Dried Fruit Beetles

Trapping of Adults. Syrup lures were hung in a Murrumbidge Irrigation Area peach orchard throughout the season. Large numbers of adult dried fruit beetles (*Carpophilus* spp.) were trapped during the period from late October to late December. Numbers declined very considerably during the rest of the season.

Apple Root Weevil

Study of Growth Rate Relationship. A long-term trial at Batlow is studying the effects of infestation by apple root weevil (*Perperus* sp.) on growth rate of young apple trees. The trees are being grown under the following conditions:

(i) In land from which old apple trees had been grubbed immediately prior to replanting; weevil infestation excluded.

(ii) As for (i), but weevil infestation not excluded.

(iii) In land which had been under pasture for 8 years after having previously grown apples; weevil infestation excluded.

(iv) As for (iii), but weevil infestation not excluded.

Growth of the trees as measured by trunk circumference and length of previous season's lateral growth, seems to have been retarded in the areas infested by root weevil as compared with trees in the areas where infestation had been excluded.

Growth is also markedly better in the area where apples had not been grown for some years, than in the area replanted after removal of old apple trees. This contrast was greater than that between "weevil" and "no weevil".

Survey of Insects and Mites of Citrus and Pome Fruits

This continued project has as the objective the compilation of a check list of insects and mites associated with apples and citrus in New South Wales. Material from several collecting trips to apple and citrus areas was identified and recorded and a systematic listing was made of all reportings of apple and citrus fauna available in Departmental records.

Noteworthy was the widespread incidence of white-fringed weevil (*Graphognathus leucoloma*) in Camden-Oakdale apple orchards. Heavy larval populations were found adjacent to roots in blocks where many trees were dead or dying. The condition of the trees was probably due to root damage by this pest.

Citrus Gall Wasp

Incidence of citrus gall wasp (*Bruchophagus fellis*) on backyard trees in the Sydney district was again lower than in the previous year. This is considered to be the result of gall wasp parasite (*Epimegastigmus brevivalvus*) activity, and of the gall wasp eradication campaign by Departmental fruit inspectors.

B. fellis bred from the desert lime (*Eremocitrus glauca*) from northwest New South Wales attacked and galled common lemon seedlings in laboratory studies. But larvae did not develop in the galls.

The long-term trial at Oxford Falls to determine effect of gall wasp infestation on Eureka lemon trees and to test spray applications in spring for gall wasp was continued. Development of infestation on the Eurekas has been extremely slow, irrespective of treatment, but galling of common lemon suckers under the trees has been rapid and severe.

Citrus Red Scale

Incidence. In lower Murray districts infestation of fruit by red scale (*Aonidiella aurantii*) was heavier than is usual in November. It continued at problem levels through summer and autumn in some orchards. Infestations of trees and fruit in the Murrumbidgee Irrigation Area were particularly heavy in late summer. In coastal districts the red scale damaged some blocks of young trees, especially in dusty situations.

Spray trials in the M.I.A. Final assessments in the 1966–67 season's red scale spraying trial on Valencia oranges in the Murrumbidgee Irrigation Area, of single treatments applied at the beginning of March, showed that maldison high concentrate liquid at 0.15 per cent plus white oil 1/100 and 0.1 per cent plus white oil 1/100, and the new organophosphorus compound folimat e.c. 0.055 per cent plus white oil 1/100, and phenthoate w.p. 0.05 per cent plus white oil 1/100 compared favourably with the standard treatment of dimethoate w.p. 0.03 per cent plus white oil 1/100. None of the materials caused fruit blemish.

In the 1967–68 season's spraying trial on Valencia oranges in the Murrumbidgee Irrigation Area, single applications of promising organophosphorus compounds, including maldison high concentrate and folimat, were made with white oil 1/100 in the first week of March—to heavily infested trees. Differences between most treatments were not apparent at the preliminary counts in winter, but fenitrothion w.p. 0.06 per cent plus white oil 1/100 was inferior to the other treatments.

Disinfestation of Oranges with EDB. Fumigation of red scale infested oranges with ethylene dibromide (EDB) at fruit fly treatment schedules of 18 oz EDB per 1,000 cu ft at 70°F, 24 oz per 1,000 cu ft at 60°F, and 32 oz per 1,000 cu ft at 50°F, in two-hour chamber fumigation, gave complete mortality of populations of 1,500 scales examined per treatment.

Hard Wax Scale

An undescribed species of hard wax scale (*Ceroplastes* sp.) on mandarins, first seen in March, 1967, at West Pennant Hills, was recorded this year in two Castle Hill localities.

Observations showed a life cycle of one generation per year, with emergence of larvae in early autumn from eggs formed in summer under the old parent scales. The young larvae settled and remained on the leaves until early winter. Then they migrated to permanent positions on stems, formed waxy coverings and developed into adults.

Citrus Red Mite

This important citrus pest (*Panonychus citri*) with almost world-wide distribution was found heavily infesting a few trees of trifoliata (*Poncirus trifoliata*) in the Gosord district in March, 1968. This is the second record of citrus red mite in Australia. The first record was trace infestation on lemon trees at Oxford Falls, in Sydney metropolitan area, in October, 1966.

Stem End Scurfing Blemishing of Citrus (Thrips?)

Incidence.—There was less incidence of the flat scurfing blemish around the stem end of oranges and grapefruit this year. This blemishing has troubled some lower Murray orchards. Thrips feeding on very young fruits are the suspected cause.

Spray Trials.—In a preliminary trial at Dareton, grapefruit trees were sprayed in mid-November, 1966, with azinphos methyl w.p. 0.05 per cent plus white oil 1/100 post-bloom. There were 6.5 per cent and 29 per cent blemished fruits on sprayed and unsprayed trees respectively by November, 1967.

In a similar trial at Monak, Valencia trees were post-bloom sprayed in mid-November, 1967. Occurrence of blemised fruits in June, 1968, was 1 per cent for the azinphos methyl w.p. 0.05 per cent plus white oil 1/200 treatment, and 15 per cent for untreated trees.

Passion Vine Hopper

A consignment of eggs of the hopper (*Scolypopa australis*) containing a parasitic scelionid wasp from privet at Matcham was sent in March to the New Zealand Department of Scientific and Industrial Research, Auckland, for biological control investigations.

DDT and Bees in Orchards

Observations at Bathurt and Orange.—Very large quantities of emulsion-type DDT were applied to apple orchards at Orange and in many other districts in order to control a severe outbreak of plague thrips. The insecticide was used mostly at 0.1 per cent a.i. as a fully dilute spray, but occasionally at approximately 0.25 per cent a.i. in semi-concentrate machines. Usually, at least two applications were made during the period from pinking to full bloom. Sprays were mostly applied at times of minimum bee activity in the orchards.

Responses to enquiries made of apiarists who had hives in orchards at apple blossom time indicated no undue mortality of bees.

In an orchard at Bathurst, two applications of emulsion-type DDT 0.1 per cent a.i., at a 6-day interval, were made to apple trees during the daytime when bees were actively working the blossoms. Beehives sited in this orchard were examined 10 days after the second spray application. There was no evidence of dead bees around the hives. A further examination, a week later, indicated no dead bees and the broods appeared perfectly normal.

This evidence has indicated that DDT at 0.1 per cent a.i. is a relatively safe insecticide to use around bees.

STORED PRODUCT PESTS

Wheat Pests

Dust Protectant Trials. The trial of dust protectants, started in May, 1965, at Condobolin Agricultural Research Station with treatments four times in 44-gallon drums, ended in December, 1967.

Untreated grain became infested by lesser grain borer (*Rhyzopertha dominica*) within a year of the start; by confused flour beetle (*Tribolium confusum*) within 2 years; and by saw-toothed grain beetle (*Oryzaephilus surinamensis*) in the final year of the trial.

Replicates treated with maldison 10 p.p.m. remained free of insect infestation throughout the trial. Those treated with fenitrothion 2.5 p.p.m. and 5 p.p.m. became infested by *T. confusum* towards the end of the trial and proved less effective than maldison against *R. dominica* in laboratory tests when insects were introduced into samples from the trial. Replicates treated with bromophos 6 p.p.m. became heavily infested by *R. dominica* after 2 years, but remained free of infestation by the other two insects. Replicates treated with diazinon 4 p.p.m. were infested by *T. confusum* and a light infestation of *O. surinamensis* during the last year of the trial, but the grain remained free of *R. dominica.* The carbaryl 10 p.p.m. and synergised pyrethrin 1.7 p.p.m. treated replicates were infested by *T. confusum* within 2 years, with light infestation by *O. surinamensis* during the last year of the trial, but remained free of *R. dominica.*

A trial to compare finely-ground magnesite and maldison dust as protectants for wheat stored in grain silos was commenced at Condobolin Agricultural Research Station in December, 1966, and concluded in December, 1967. The magnesite was added to wheat during filling of two iron silos (2.000 bushel capacity) at the rate of 1 per cent by weight. The maldison 10 p.p.m. was applied to wheat as a 2 per cent talc-based dust as it was augered into a third silo. A fourth silo was filled with untreated grain as a control.

The untreated grain became heavily infested within a few months by *O. surinamensis* and *R. dominica,* as did wheat treated with magnesite. One silo of wheat treated with magnesite also became infested by rice weevil (*Sitophilus oryzae*). The maldison treated wheat remained free of insect infestation throughout the trial.

Maize Pests

Field Infestation Survey. Field infestation of maize by stored grain insect pests was surveyed during May in the Quirindi, Tamworth, and Armidale areas, and in coastal areas from Macksville to Maitland.

Absence of infestation in inland crops contrasted with the serious infestation of coastal crops by maize weevil (*Sitophilus zeamais*) and Angoumois grain moth (*Sitotroga cerealella*).

Dust Protectant Trials. A trial of protectants for maize on the cob started at Grafton Agricultural Research Station in September, 1966, and ended in December, 1967. Untreated control cobs became infested by *S. cerealella, S. zeamais,* rice weevil (*Sitophilus oryzae*) and rust red flour beetle (*Tribolium castaneum*).

The maldison 40 p.p.m. formulated as flour-based and talc-based dusts protected cobs from all those pests for the full period of the trial, despite proximity of heavily infested maize. At 20 p.p.m. the maldison was much less effective, particularly the talc-based preparation. The magnesite at 0.5 per cent and 1 per cent by weight was ineffective against all of those pests, as was silica aerogel sorptive dust.

A trial of six dust protectants for maize grain, replicated three times, started at Grafton Agricultural Research Station in September, 1966, and ended in December, 1967. Untreated grain was ruined by Indian meal moth (*Plodia interpunctella*), *S. cerealella, S. zeamais, S. oryzae,* and *T. castaneum.*

As a flour-based dust, maldison at 12 p.p.m. and the silica aerogel 0.1 per cent by weight prevented infestation by any of those pests for a period of 11 months. The talc-based maldison 12 p.p.m., the talc-based fenitrothion 5 p.p.m., and the lindane 5 p.p.m. treatments remained free of infestation for 5 months. They were then infested by *S. oryzae* and later by *S. zeamais, T. castaneum,* and *S. cerealella.*

The commercial grain protectant magnesite 1 per cent by weight replicates were infested by *P. interpunctella* within 2 to 3 months of treatment. Infestation by other pests was lighter in the magnesite treatment than in the maldison (talc-based), fenitrothion, and lindane treatments.

A trial of protectants for hammermilled maize started at Grafton Agricultural Research Station in September, 1966, and ended in August, 1967. Treatments, replicated four times, included magnesite 0.5 per cent and 1 per cent by weight, silica aerogel 0.1 per cent by weight, and maldison 12 p.p.m. (as a 1 per cent dust); and an untreated control .

None of these treatments was effective in preventing fairly rapid infestation by *S. zeamais, S. oryzae, T. castaneum,* and saw-toothed grain bettle (*Oryzaephilus surinamensis*). Later, the flat grain beetle (*Cryptolestes* sp.) also became numerous in all treatments.

Spray Protectant Observations. Observations were made from June to October, 1967, on a horizontal bulk containing 1,800 tons of maize grain sprayed before storage with maldison 20 p.p.m. This was portion of nearly 9,000 tons of maize treated by a maize processing firm and was the first use of the protectant on such a large quantity of maize.

Grain from the bulk was sampled at monthly intervals over the 4-month observation period and exposed in the laboratory to infestation by *S. zeamais, S. cerealella, T. castaneum* or *T. confusum,* and *O. surinamensis.* The protectant remained effective throughout the storage period, except at one end of the bulk. Damage by water had occurred there.

Study of Stored Hammermilled Maize Susceptibilities. Experimental storage of hammermilled maize cobs in bulk at Grafton Agricultural Research Station from December, 1966, to December, 1967, demonstrated the effectiveness of this method in reducing loss from insect infestation.

By August, two-thirds of the original 500 bushels had been removed from the bulk and used as feed. The grain was in good condition when removed and was readily accepted by dairy cattle, despite some insect infestation of the surface layer.

Surface layers of grain were infested by *T. castaneum, Cryptolestes* sp., *S. zeamais, S. oryzae, O. surinamensis,* and also by dried fruit beetle (*Carpophilus* sp.). Infestation by the first-named two species also occurred in deeper layers of grain, but was much lighter than at the surface. Infestation by *P. interpunctella. S. cerealella,* and tropical warehouse moth (*Cadra cautella*) also occurred on the surface in the first two months of storage.

Throughout the storage period, temperature remained higher at depth than on the surface and the high temperature level in the deeper layers could have depressed insect infestation of the bulk of the material.

The temperature range in the last 6 months of storage was similar to that recorded at earlier samplings. In August it was 81–90°F at depth and 74–82°F on the surface. In December it was 95–98°F at depth and 85–89°F in the surface.

Maize and Rice Weevil Infestations of Cereal Grains

A laboratory test of ability of maize weevil (*Sitophilus zeamais*) and rice weevil (*Sitophilus oryzae*) to develop in wheat, oats, sorghum, and maize was started in October, 1967. At constant temperature of 80°F and relative humidity of 55 per cent, both species bred prolifically in wheat and sorghum. But neither became well established in oats or maize, possibly because the original moisture content was not as high as that of the wheat and sorghum.

Pests in Packaged Cereals

Trial of Repellants. Pyrethrine-piperonyl butoxide treatments in printing ink, glue, and varnish were tested as repellents for insects invading packaged cereals. Formulations were prepared and applied to cardboard packages by a printing and packaging firm.

The packages were filled with sterilized rolled oats and exposed in a room containing a mixed population of Indian meal moth (*Plodia interpunctella*), saw-toothed grain beetle (*Oryzaephilus surinamensis*), confused flour beetle (*Tribolium confusum*), rice weevil (*Sitophilus oryzae*) and lesser grain borer (*Rhyzopertha dominica*).

Packages for each treatment were examined after 1, 3 and 6 months storage. No treatment was completely effective in preventing invasion, but far fewer insects were found in packets where adhesive containing pyrethrinspiperonyl butoxide had been applied to the flaps. It was the only treatment to give reasonable protection against *O. surinamensis.* This was the main invading species, with *T. confusum* also present in some numbers.

Pests in Meatmeal

In January, insects infesting meatmeal which had been held in bulk storage for 2 years at a Sydney abattoir were investigated.

Pests present were hide beetle (*Dermestes macalatus* and *D. frischii*), drugstore beetle (*Stegobium paniceum*), red-legged ham beetle (*Necrobia rufipes*) and the cadelle (*Tenebroides mauritanious*).

Meatmeal that had been wet along one wall was infested by lesser meal worm (*Alphitobius diaperinus*), and the webbing clothes moth (*Tineola biselliella*) was found on wool fibres and hair on the surface of the meal.

Infestation by all these pests was confined largely to the surface layers of the meal. Control was had by applying a spray of diazinon 0.5 per cent a.i. to the surface at the rate of 1 gallon to 1,500 square feet.

VEGETABLE PESTS

Potato Moth (Phthorimaea operculella)

Parasites' Establishment.—A joint project with the CSIRO has shown that the wasp parasites *Apanteles subandinus, Orgylus* sp. and *Copidosoma koehleri* could establish in the field at Orange, could persist from season to season and, at least in the case of *A. subandinus* could achieve a high rate of parasitism of potato moth larvae.

In 1966–67 this rate of parasitism approached 80 per cent. It was much lower in 1967–68, and foliage infestation by potato moth was considerable in this season.

ANIMAL PESTS

Sheep Blowfly

Culturing Resistant Strains of the Fly.—In an attempt to establish alternative compounds against sheep blowflies (*Lucilia cuprina*) resistant to organophosphorus and carbamate, the following strains are being cultured for test purposes:

(a) *DB strain*: This strain is three to five times tolerant to a wide range of organophosphorus chemicals. It is being perpetuated through females which survive 0.1 of a microgram of diazinon per female.

(b) *G strain*: This strain has a resistance factor of about tenfold normal to a wide range of organophosphorus insecticides. It is being subjected to pressure of 0.2 of a microgram of diazinon per female. It is also resistant to butocarb. This resistance is being held by exposure of larvae to butocarb.

(c) *Q strain*: This strain was obtained from a private laboratory and was reputed to have a resistance factor of about twenty times normal to diazinon. It is being pressured with 0.25 of a microgram of diazinon per female. But the methods of testing, involving application of diazinon in kerosene at the rate of 0.5 of a microlitre per female, indicate that its resistance factor is ten to twelve times normal.

Laboratory Screening Studies.—Use of experimental phosphonate insecticides on the G strain have demonstrated that the resistance factor to these chemicals is in the order of two times normal, with both larvae and adult. This work is currently being extended to the DB and Q strains.

Field Performance of the Insecticides.—Due to drought conditions for most of the fly wave periods, it was not possible to check on the field performance of organophosphorus and carbamate insecticides.

A repeat series of semi-field work involving sheep treated with registered organophosphorus and carbamate insecticides, and the subsequent implantation with maggots from a susceptible colony and the G strain, suggests that organophosphorus insecticides well applied will give practical prevention of flystrike.

A similar comment applies in regard to butocarb, provided the order of resistance to it does not significantly increase as a result of further field pressure.

DOMESTIC PESTS

Argentine Ants (Iridomyrmex humilis)

Spraying continued from 1st July, 1967, to 23rd March, 1968. By this date all known areas had been treated.

This year a total of 493½ acres in sixteen infestations was sprayed with 46,135 gallons of 2 per cent chlordane.

Several large infestations involving fruit-growing and grazing properties were treated at Pitt Town, Eastern Creek, and Dural, all outlying parts of the Sydney metropolitan area.

An area of 32 acres was treated at Oak Flats, Municipality of Shellharbour. This was the first infestation reported outside of Sydney and Wollongong.

Since April, 1950, a total of 304 infestations covering a total of about 7,400 acres has been reported in Sydney and Wollongong and at Oak Flats.

A pre-spraying survey of a small infestation reported last year from Zetland, and included in the total of 304, was undertaken in March. As Argentine ants were not evident, the area was not treated.

A total of 299 infestations has been sprayed. Four recently found infestations amounting to 45 acres await spraying.

Surveying of treated infestations not previously checked was commenced in March. No Argentine ants were found in the 298 acres surveyed. A total of 223 of the 299 infestations sprayed since 1951 has now been checked and these areas are apparently free from Argentine ants.

SYSTEMATIC STUDIES

Distribution and Taxonomy of Aphids

Aphid trapping programmes were continued and several thousand specimens were identified. Several new records were obtained and three undescribed species were referred to the Waite Agricultural Research Institute for study.

Spider Mites

Sixteen species of the Family Tetranychidae have been recorded in N.S.W. during the course of a study to determine the distribution and host range of spider mites in the State.

Two mites, the sugar cane mite (*Oligonychus sacchari*) and *Bryobia cristata,* were recorded for the first time in N.S.W. Citrus red mite (*Panonychus citri*) was recorded on mature trees of *Poncirus trifoliata* at Somersby; the first record of the species in a commercial citrus growing area in N.S.W. and the first record of the pest on trifoliata. The grass webbing mite (*Oligonychus digitatus*) was recorded for the first time from West Wyalong and Dubbo.

The Insect Collection

This year 10,864 insects were added to the collection. Most of these were Coleoptera. The various families of Coleoptera were re-arranged to coincide with more recent views on arrangement of the Order.

Intensive work on the Tenebrionidae completed the detailed re-arrangement of the species, including incorporation of many specimens.

Study of the Curculionidae

Another 628 specimens were added to the collection, in the following subfamilies: Brachyderinae (90), Leptopinae (73), Amycterinae (24), Gonipterinae (69), Hyperinae (22), Cleoninae (33), Hylobiinae (36), Erirhininae (56), Amalactinae (1), Laemosaccinae (10), Haplonychinae (48), Cryptorhynchinae (137), Rhynchophorinae (29).

The former subfamilies Belinae, Attelabinae and Apioninae have been raised to family rank. Some preliminary work was done on the genera *Perperus* and *Prypnus*.

Chemistry Branch

STAFF

General

There was no major administrative change in the Chemistry Branch this year but the designation "Senior Chemist" was altered to Deputy Chief Chemist. The holder of this designation at Rydalmere is Dr D. K. O'Neill. Mr J. Dingle, Senior Chemist, Tick Board of Control, Lismore, was also redesignated, viz., Deputy Chief Chemist (Tick). Cereal Chemist Mr E. H. Jacob was regraded to Special Grade.

Chemists Miss L. Hilton and Mr T. Abbott are on study leave at the University of Sydney.

A position of Chemist was created and filled for particular attention to studies of oils and fats from oil seed crops in N.S.W.

Overseas Study Tour

Waters Chemist, Mr M. G. Shatfield in May, 1968, commenced a 3 months overseas study tour. His itinerary provides consultations in the U.S.A., United Kingdom, Netherlands and Israel on plant, soil and water relationships; with specific reference to effects of soil or irrigation water salinity on crop production, and management to reduce hazards associated with inferior and marginal waters. He will also inspect the Sea Water Desalination Plant in San Diego, California, and discuss problems in large-scale desalinization.

CEREAL CHEMISTRY SECTION

Laboratory Output and Statistics

Grain and Flour Samples.—Sixteen hundred and seventy-two samples were received, as against 2,057 for the previous year. The reduction reflected the season's smaller wheat crop and the smaller total of trials harvested. For example in the dry conditions the 1/40th acre trials at Trangie were not sown.

Of the 1,672 samples, 201 were flour. These were drawn mainly by Export and Import Branch personnel, for laboratory testing prior to certification of export shipments.

The Range of Physical and Chemical Tests.—The range was considerable, as shown by the following statistics; farinographs, 414; extensograph, 390; electronic moisture determinations, 1,638; air oven moisture determinations (standard method), 759; pearling resistance, 724; flour ash, 393; and wheat and flour protein determinations, 3,592.

Also, the following tests were done on each of 350 flour samples: a starch damage estimation, a maltose determination, an amylograph and sedimentograph, and the Hagberg falling number determination.

Milling and Baking. Including samples from the 1966–67 as well as the 1967–68 harvest, 1,158 milling units from 507 samples were produced on the Buhler laboratory mill and 1,522 test loaves were baked from these.

Individual Research Programmes. Numerous tests were done in connection with research programmes and investigations.

The 1967–68 *Wheat Crop*

Production. See "Wheat" (page 26) in Division of Plant Industry section of this Report of the Department.

Three Grades Declared. Three grades were officially declared, namely Northern F.A.Q., South-Western F.A.Q., and Prime Hard. The wheat is bright and attractive, contains on average only about 0.3 per cent admixture, and 2.5 per cent cracked, broken, and small grain. The bushel weights for the standard samples were surprisingly high, in view of seasonal conditions, respectively 1½ and 1¼ lb higher for the Northern and South-Western F.A.Q. than were the previous season's standards.

Protein Content at Record Level. Protein levels overall were the highest ever recorded in N.S.W. They reflected the season's effects of reduced yield combined with the increasing fertility levels.

The Northern F.A.Q. had 13.7 per cent protein, the South-Western F.A.Q. 13.5 per cent protein and the Prime Hard averaged 15.7 per cent protein; quoted on the International Standard of 13.5 per cent moisture.

Actually, most of the wheat harvested is averaging 10.0 per cent moisture content, gives a protein content in excess of 14.0 per cent for the two F.A.Qs. and in excess of 16.0 per cent for the Prime Hard.

Protein Content—Silo Survey. Every year a representative sample is taken from each receival point in N.S.W. and analysed for protein content. Of the 240 samples this season, exactly 50 per cent (i.e. 120 silos) had protein contents in excess of 14.0 per cent on a natural (i.e. as received) moisture basis, 19 sites had protein above 16.0 per cent, and three (Coonamble, Grenfell, and Wallendbeen) had protein above 18.0 per cent.

Only 16 silos showed below 12.0 per cent protein and most of these held some irrigation wheat.

Premium Sales. Because of the overall high protein content of this crop, demand by local mills for high protein wheats was greatly reduced. The premium average of 10.8 cents per bushel and the 720,000 bushels concerned would each be the lowest in the last 10 years.

The soft variety premium sales were normal both for quantity and premium.

The remaining 12.85 million bushels of prime hard wheat, destined for export, should eventually command a premium when sold and shipped.

Uniform Quality Testing of Wheat

Uniform Quality Testing Committee. Following Ministerial approval of recommendations from the N.S.W. Production and Marketing Committee, the Uniform Quality Testing Committee has been formed. The cereal chemist is convener and chairman. Other members are the cereal chemist of the Agricultural Research Institute, Wagga, the Director of the Bread Research Institute, and a cereal chemist nominated by the N.S.W. Flour Millers Council.

The committee's function is to examine plant breeders' crossbreds approaching release and compare these with currently recommended varieties.

The Uniform Quality Testing Committee (U.Q.T.C.) met twice this year, to consider laboratory results from the crossbred N.B.J.115 compared with Heron and Olympic. The samples were from the last two harvests and this represented two widely different growing seasons.

New Crossbred N.B.J.115 for Naming and Release. The U.Q.T.C. agreed in light of all quality factors that N.B.J.115 was comparable with Olympic and, if anything, superior to Heron. The crossbred also has excellent agronomic characteristics. Therefore action to name the crossbred will now proceed, by application to the Registrar of Cereal Varieties in Australia.

The Department will recommend to the N.S.W. Standing Advisory Committee on Wheat the release of the new variety in the crop year of 1969.

Wheat Variety Releases Recommended by Standing Advisory Committee

Robin and Timgalen Release Recommended. The cereal chemist attended the 1967 spring meeting of this Ministerial advisory committee, the N.S.W. Standing Advisory Committee on Wheat. The committee recommended release of two new varieties: Robin for southern and western sowings and Timgalen for northern sowings in crop year 1968.

Robin had been previously twice before the Uniform Quality Testing Committee as "crossbred K.F. Heron" and Timgalen had been Uniform Quality tested as "crossbred T.R.135".

Cereal Grain Moisture Studies

Moisture content is an important factor in the keeping quality and monetary value of grains. It is particularly important for coarse summer grains such as maize and sorghum. These are normally autumn harvested, when natural field drying does not reduce the moisture to safe storage levels.

Grain Sorghum Work. Interest in cereal sorghum is rapidly increasing because of the higher yields under irrigation and the potential of export markets. This has necessitated an examination of methods for moisture determination of grain sorghum in connection with both grain storage and grain drying and for export certification requirements.

This year, a series of trials was conducted with a range of moisture meters to assess their value in measuring grain sorghum moisture. Tests were conducted over 10 per cent–20 per cent range of moisture contents, with whole grain and ground grain samples.

The meters used were found to compare favourably with standard laboratory procedures. By taking proper precautions, grain sorghum moisture content determinations in the field would be accurate up to a moisture content of 20 per cent.

Royal Agricultural Show—Wheat Judging

The cereal chemist and senior cereal technician acted as judges in collaboration with a nominee of the Flour Millers Council.

The total of 136 entries in Open Classes for the R.A.S. wheat (grain) championships was significantly greater than usual and necessitated adoption of rapid laboratory methods if the judging were to be done without disrupting the cereal chemistry programme as a whole.

General standard of entries was high. The extremely high protein contents made difficult the final separation of samples. The varieties Gamut, Falcon, and Heron won championship awards in their respective classes.

Soft Wheat Quality Investigations

Flour Particle Size. Flour particle size is important to biscuit wheat quality. Biscuit flours are characterized by fine particle size distributions. The continuing studies are concerned with effects of variety, location, and protein content on this quality factor.

Recent developments in the centrifugal-air classification of flours are relevant to the work. This process classifies flours by particle size. The 0-17 micron fraction has twice the protein content of the parent flour, and is used for protein-enrichment of lower protein flours. The 17-40 micron fraction is low in protein, and is used for biscuit manufacture where a low protein flour is required.

Only varieties capable of yielding a flour with a large percentage in the less than 40 micron range are suitable for the centrifugal-air process, and this is being studied. The first problem was to develop an accurate and relatively rapid method to determine particle size. Efforts have concentrated on this problem and a method has been developed using a Shimadzu Sedimentograph.

A paper on the so developed method was presented by an officer of the Section to the 1967 Cereal Chemistry Conference.

Weather Damaged Wheat

High Incidence in 1966–67 *Crop.* The 1966–67 season was notable for severe weather damage to wheat. Up to 40 per cent of the crop in some regions was affected. Grain samples from this season have been used in current investigations.

Relationship of Rainfall Near Harvesting. Statistical analysis of rainfall on the mature crop was estimated from Meteorological Bureau daily rainfall records. There was a correlation of —0.886 between bushel weight and the rainfall between crop ripening and harvesting.

The regression showed that approximately one inch of rain lowered by 1 lb the bushel weight. Consequently, the breeding of varieties with high bushel weights is important. High bushel weight varieties have a greater resistance than have low bushel weight varieties to the lowering of bushel weight to below 59 lb by the weather. Below 59 lb bushel weight the wheat is downgraded by the Australian Wheat Board.

The Hagberg Falling Number Apparatus. This is a recent Swedish development, to determine weather damage. The method is rapid, and the instrument is portable and suits field use. One of the instruments has recently been acquired by the Cereal Section and is being used in the studies.

Paper for Publication. A paper on detection of small increases in enzyme activity resulting from weather damage has been accepted for publication.

Certification of Export Wheat and Flour

Export Wheat. Examination and testing of all shipments from Newcastle and Sydney continued. This has provided not only a continual running check on export wheat but sufficient accumulation of results to allow statistical analysis. The analysis should give a clear picture of any trends in the exporting of a complete wheat harvest.

The large 1966–67 harvest has not yet been completely disposed of. Export shipments of the 1966–67 harvest have continued along with exports of the 1967–68 crop. Of shipments certified in the period January to June, 1968, 9 of the 10 from Sydney and 4 out of the 9 from Newcastle were 1966–67 season wheat.

Total shipments certified for 1967–68 were 66. Of these, 25 were from Newcastle and 41 from Sydney. China, with 52 shipments, was the major market for certified wheat. Six shipments were certified for Brazil, 5 for Chile, 2 for Peru, and 1 for Mozambique. The shipments for Brazil were independently sampled and tested by a public analyst on behalf of the buyer.

Transhipment of wheat from bulk carriers, on arrival at European ports, into small vessels for final distribution has been a development this year. It has lowered costs sufficiently to allow Australian wheat to retain a place in the very competitive European market. The bulk vessels have broken all previous capacity records, carrying quantities in the order of 40,000 and 50,000 tons.

Export Flour. Fourteen shipments of flour were certified. Up to 25 mills were represented in each consignment. More than 200 samples were examined and tested in this certification work.

Conferences, Seminars, Co-operation with Industry

Determining Sub-sieve Particle-size of Flour.—Interest created by a paper by an officer of the Cereal Section at the Cereal Chemistry Conference led to several of the staff of a major milling compiny visiting the Section to become familiar with the method of determining sub-sieve particle size of flour.

Staff of a flour milling engineering firm also asked for help in the same general field, and determinations were made on a number of flour samples separated into different ranges of particle sizes on an experimental particle separator.

Moisture Determinations for Seed Firms.—One of the staff of a major seed firm spent some weeks in the Cereal Section laboratory examining methods of moisture determination with coarse grains, sorghum in particular.

Modern Baking Methods.—W. Sloan Pty Ltd, a large bakery firm in the Weston group of companies made possible an evening visit by Cereal Section staff to inspect the large modern plant in full scale bread production.

Asian Wheat Buyers' Representatives Meet Cereal Chemist.—The cereal chemist had meetings with representatives of a Japanse wheat buying mission and representatives from Singapore and Hong Kong milling interests who were looking at Australia's wheat types and production with purchases in view.

Engineering Firms Seminar on Grain Drying.—The cereal chemist attended a seminar on grain drying conducted by Lister Blackstone Pty Ltd, an engineering firm involved in manufacture of grain drying equipment. Moisture content determinations and grain drying are closely associated and the seminar was therefore mutually advantageous.

Cereal Chemistry Conference.—Three chemists from the Branch attended the Cereal Chemistry Conference of the Royal Australian Chemical Institute at Wagga in 1967 and two of them presented a paper.

Meeting with Overseas Cereal Chemistry Authority.—The cereal chemist attended the Bread Research Institute to meet Dr B. Sullivan, a leading cereal chemist from overseas. A subject raised by Dr Sullivan was the current interest of a number of overseas countries in use of flour mill *by-products* for human in lieu of the generally accepted use for animal nutrition.

PESTICIDES SECTION

General and Methodology

Research into incidence of pesticide residues in animal and plant products has continued to expand. Appointment of a graduate chemist under the Commonwealth Extension Services Grant (C.E.S.G.) has helped considerably but it has become necessary to co-ordinate all except apple and pear spray residues investigations into a system of priorities involving all production Divisions of the Department and pesitcide residues chemists. The apple and pear residue investigations continued in a separate Commonwealth residues programme.

Gas chromatography and thin layer chromatography methods have been extended to include analysis of organophosphorus pesticide residues. To provide almost continuous usage of gas chromatography for pesticide residues analysis, further staff has been trained in the operation and associated methods including preparation of columns.

A graduate chemist appointed for formulations work has been engaged in setting up a new grating infra-red spectrophotometer purchased with C.E.S.G. funds. The instrument is being applied to analysis of formulations and dips, and methods used have included also the application of scale expansion to determine pesticide residues.

A library of standard infra-red spectra and a methods register are being compiled. The infra-red instrument has been invaluable also for rapid identification of "unknown" compounds.

Cottonseed Residues in Stock

DDT and endrin residues have been found in whole cottonseed and certain cottonseed by-products from the 1966 Narrabri crop which have a use in maintenance and nutrition of stock. Residues investigations have proceeded, to ascertain the effects of feeding cottonseed and by-products to various livestock.

Pigs in a nutrition trial at Wollongbar Agricultural Research Station were fed 10 per cent cottonseed meal in their diet for 4 months. No appreciable increases in DDT residues were found in back fat, and no endrin residues were detected. The meal contained 0.03 p.p.m. DDT and 0.003 p.p.m. endrin.

Milk samples from trial dairy herds in Windsor district receiving 15 per cent cottonseed hulls in their daily diet showed milk fat residues of up to 0.5 p.p.m. DDT and 0.2 p.p.m. DDE. No endrin was detected. The hulls were not examined for residues, but as far as could be ascertained no pesticide had been used on pastures or in the vicinity of the dairies.

Fat samples from a CSIRO nutritional trial involving feeding of fuzzy cottonseed to female cattle at the rate of 50 per cent of their diet for 8 weeks were analyzed. No endrin nor DDT residue was detected, and levels of DDD (a metabolite of DDT) were similar to those in control animals not fed cottonseed. The cottonseed, from a Queensland source, contained 0.07 p.p.m. DDT and 0.02 p.p.m. DDE, but no endrin residues.

The results of these investigations indicate that low levels of DDT and endrin in cottonseed products fed to stock may not present a problem. However, residues in cottonseed could vary from season to season, depending on number and timing of spray applications for pest control, and residues from this source in livestock could vary accordingly.

Further information on the effects of feeding cottonseed meal to beef cattle and sheep will be provided by current Trangie Agricultural Research Station trials.

Malathion Residues in Eggs

Malathion is widely used to treat stored wheat against weevil infestations. Residues found on wheat after treatment rarely exceed 10 p.p.m. A feeding trial was conducted at Glenfield Veterinary Research Station to determine whether residues of this order in poultry feed could produce significant malathion residues in eggs.

Groups of birds were continuously fed treated feed for periods of up to four weeks, and the eggs were analyzed at weekly intervals. Malathion in the feed decreased slightly over the period of the trial. No residue was detected in either the yolk or white of eggs. Limit of the G.L.C. detection method used was 0.025 p.p.m. Treatment of wheat with malathion is unlikely as indicated by these results to cause undesirable residues. A nil tolerance is imposed by the Food and Drug Administration of U.S.A. for malathion residue in eggs.

Thiabendazole Residues in Fruit

The anthelmintic thiabendazole (TBZ) has been found very effective also for control of post-harvest fruit rots. Preliminary small-scale experiments have been conducted to find what residue levels are likely from the fruit dip treatments.

Fruit were dipped in various TBZ concentrations ranging from 0.02 per cent to 0.32 per cent. Residues were determined by a colorimetric procedure and ranged from 2.0 to 13.5 p.p.m. for peaches and from 0.1 to 2.1 p.p.m. for cherries. Analysis of bananas and oranges are proceeding.

No Departmental recommendation for use of TBZ on fruit has yet been made. However, the Food and Drug Administration of U.S.A. has recently approved its use on bananas, at 3 p.p.m. tolerance for whole fruit and 0.4 p.pm. for pulp.

Residue data from the foregoing experiments will be considered by the National Health and Medical Research Council when determining tolerances and the possible release of TBZ for horticultural use in Australia.

Carbaryl Residues in Sheep

Because carbaryl may be used more extensively to treat pastures against insect pests, an experiment was conducted at Glenfield Veterinary Research Station to find what residues occur in sheep grazed on treated pasture.

The pasture was treated at the rate of 16 oz carbaryl/acre. One group of sheep was put on the pasture as soon as the sprayed carbaryl had dried and a second group was withheld for four days. A four-day withholding period is a tentative Departmental recommendation for carbaryl.

The carbaryl on the pasture diminshed by 50 per cent in four days, and 75 per cent in 10 days. And after 49 days barbaryl was not detected (< 1 p.p.m.). Although sheep were grazed for periods up to 28 days, carbaryl was never detected in fat tissues. The limit of detection of the colorimetric method used was 0.25 p.p.m.

These results indicate that there is no great hazard in allowing sheep to graze almost immediately after spraying the pasture with carbaryl.

The Food and Drug Administration of U.S.A. does not list a tolerance for carbaryl in sheep fat (Dec. 1966 list).

DDT and Dieldrin in Tomatoes

An experimental sample of tomatoes was submitted by the Northern Territory Administration for analysis for dieldrin and DDT residues. The tomato plants had been treated, misted at 10 day intervals, from 3 weeks after transplanting to 3 weeks prior to fruit collection, with an emulsion comprising 0.07 DDT and 0.04 dieldrin. The following residues were found: dieldrin, 0.17 p.p.m.; pp' DDT, O.76 p.p.m.; and pp' DDE, 0.01 p.p.m.

According to the tolerances of the Food and Drug Administration of U.S.A., these residues are excessive for dieldrin, but acceptable for DDT.

DDT Residues in Rice

DDT has very effectively protected young rice seedlings against bloodworm attack, and maturing crops against armyworm. The bloodworm control has been by dusting seed with DDT or placing DDT emulsion in the early irrigation water. The armyworm control has usually been achieved through aerial spraying.

Analyses of rice grain samples submitted by Yanco Agricultural College and Research Station showed that DDT residues from aerial spraying were highest, ranging from 3.3 to 20 p.p.m. for paddy rice down to 0.28 p.p.m. for dehusked rice. Residues in rice grown from dusted seed or from the water treatments were much lower, and similar to each other, ranging from 0.03 to 0.05 p.p.m. for paddy rice and 0.02 to 0.03 p.p.m. for dehusked rice.

There is no F.D.A. tolerance for DDT in rice (as at Dec., 1966). However, residues from aerial DDT treatments could be considered excessive. The very low residues from bloodworm control treatments could be considered permissible.

The extreme dilution of DDT in irrigation water appears to present little or no hazard to fish life from the use of DDT for bloodworm control in rice crops.

Hexachlorobenzene Residues in Poultry

Discovery of hexachlorobenzene (HCB) residues in some eggs and feeds has led to two feeding trials at Glenfield Veterinary Research Station to ascertain residue hazards from use of feed contaminated with HCB.

The first trial has involved feeding laying hens with a ration containing HCB at a rate similar to that recommended for fungicidal treatment of seed wheat. Groups of birds were fed on treated feed for periods up to 4 weeks, but HCB contamination of egg yolk so greatly exceeded what is found in practice (up to 2 p.p.m.) that a further trial involving lower rates of HCB feeding was required.

A second trial has involved feeding at rates up to 8 p.p.m. HCB for 4 weeks, followed by 4 weeks feeding on untreated feed. In this trial the residues found in egg yolk indicated that feed containing less than 1 p.p.m. HCB could account for the maximum levels found in practice. Residue in the eggs declined only slowly over the period on untreated feed.

These trials indicated the danger of incorporating treated seed in stock foods ,and the need for stricter control of supplies of treated seed.

Dieldrin Content of Treated Soil

Nine soil samples from Coff's Harbour were analysed on behalf of the Maritime Services Board of New South Wales to determine dieldrin content after treatment with a dieldrin solution some months earlier. The Board is required to guarantee ant control in timber exported to New Zealand, and accordingly is applying dieldrin in the "Sterile Transit Parks". Dieldrin normally has a long residual life and the Board needs to know the residue in covered and uncovered areas of soil 3 months after applying the pesticide.

Further analyses are to be made, about 6 months hence, to determine the necessity for respraying treated areas.

Formulations of diazinon

Two separate problems have arisen this year.

The first concerns registration of two new formulations under the Stock Foods and Medicines Act. Complaints about the stability of these formulations during storage were investigated. The material was found to be unable to comply with the World Health Organization's specification for diazinon stability. As a result the manufacturers withdrew and reformulated the products. After this they were acceptable in stability and considered satisfactory for registration.

The second complaint related to death of cattle sprayed with diazinon to control lice. Death was due to organophosphate poisoning. When the formulation was analysed it was found that complete breakdown of the diazinon had occurred, resulting in formation of highly toxic TEPP. The latter was identified in the sample by infred-red spectrophotometry. The user had also used double the correct strength of spray. This could have increase the toxicity.

The possible paths of decomposition of diazinon were investigated, using the infra-red spectra of various samples.

Formulations of Salicylanilide

Complaints, concerning effectiveness of salicylanilide, used as a banana dip, led to an examination of the active ingredient concentration of commercial formulations. This work is continuing during 1968–69.

Complaints concerning phytotoxicity were also investigated, in laboratory tests of the possible effects of overdipping in dips of correct strength. Dipping bananas for an hour showed the sodium salt formulations to be much more phytotoxic than the suspension types. The sodium salt dips also were more adversely affected by overdipping than the suspension types.

Infra-red spectroscopy was found unsuitable for analyses of salicylanilide dips.

Ethion-in-oil Formulation

Phytotoxicity to grapefruit was reported after spraying with a commercial form of ethion-in-oil. Emulsion overstability combined with the extreme climatic conditions, was suggested as the possible cause. This idea is being tested by the manufacturer.

Various methods of emulsion stability testing were developed for this study, and infra-red spectroscopy was used to characterize various oils and emulsifiers.

Ten-eighty (1080) *in Wheat*

A sample of wheat supposedly causing deaths of poultry was examined by infra-red spectroscopy and, by comparison with the pure material, 1080 (sodium monofluoroacetate) was identified in the grain. Wheat poisoned with "1080" had been used as a rat bait in the area from which the sample came. Contamination of stocks with baited grain could have occurred.

Queen Bee Mortalities

Queen beets isolated in cages for transfer were found to be dying rapidly. The cages were examined for toxic materials. Infra-red spectroscopy showed the wire to be coated with an oil contaminated with cyanide (either from fumigation or the plating process). A method of decontamination has been developed.

Apple Residue Studies

Mercury Residues on Apples.—Relationship between number and timing of sprays and the residues in the fruit at harvest was investigated by applying special spray treatments in 1966–67 at Bathurst Agricultural Research Station and at Armidale.

Jonathan and Granny Smith apples were used at each place and up to four applications were made with 0.005 per cent phenyl mercuric chloride as follows: (a) at spur-burst; (b) at spur-burst and early November; (c) at spur-burst, early November and early December; and (d) at spur-burst, early November, early December, and early January. Four trees were subjected to each type of spray treatment.

At harvest time in 1967 one sample of sixteen apples was taken from each tree, at half height approximately evenly from all sides of the tree. The Jonathans were harvested early in March and the Granny Smiths about a month later.

All analyses were made, using the A.O.A.C. method, on diced samples of whole fruit, prepared using a sector from each apple, the core portion being discarded.

The mercury residues in the whole fruit ranged from a negligible amount in the samples sprayed only at spur-burst to a value of 0.04 to 0.06 p.p.m. in fruit sprayed four times, i.e. up to early January. There was no marked difference in residues between the two varieties, but in all samples from Armidale the values tended to be higher than in the corresponding samples from Bathurst.

Dodine Residues in Apples.—Three samples of commercially sprayed Granny Smith apples from Bilpin were analysed soon after harvesting, for dodine residues; surface and total residues. The number of spray applications varied from five to ten and the interval from last spray to harvest varied from one to thirteen weeks.

Surface residues varied from 0.34 to 1.00 p.p.m. and total residues from 0.88 to 1.27 p.p.m. All were well below the F.D.A. tolerance for dodine in apples or pears, viz. 5 p.p.m., although all three had received a substantial number of spray applications, and in two instances the interval between last spray and harvest was very short.

The results indicated that a considerable proportion of the dodine is in the pulp of the fruit; a fact apparently well recognized.

Residues of Matacil.—A sample of commercially sprayed Granny Smith apples from Tasmania has been analysed for residues of this insecticide. The infra-red spectroscopic method of Niessen and Frehse (*Pflanzonschutz-Nachr.* (Bayer) 16 (1963) 205–220) was used. The residue found was approximately 0.2 p.p.m. No F.D.A. tolerance has yet been set for Matacil.

Collaborative Study of Mercury Residues.—Eight government laboratories in five States collaboratively studied a sample of apples which had been dipped in a suspension of phenyl mercuric chloride. The methods of analysis used were not the same. Most used the A.O.A.C. method but one used the British method employing selenium, and one used a later British method described in *The Analyst* (1965. p. 515).

The results showed wide variations as between laboratories. There was fair agreement between laboratories using the A.O.A.C. method but those using the British methods found much higher residues.

Towards explaining these variations the same laboratories made a second collaborative study. They used solutions of mercuric chloride and of phenyl mercuric acetate, the concentrations not known to the analysts. The laboratories were asked to add a prescribed amount of each solution to diced apples which had not received any mercury sprays. Results showed much less variation than before, but further investigations may be necessary.

Miscellaneous Samples

Iindane, for plague locust control, submitted by the Government Stores Department and pyrethrum used in fumigation by the Australian Wheat Board were analysed successfully by infra-red spectroscopy.

Samples including soil, unidentified powders and unlabelled sprays were examined by infra-red for identification of components.

A large number of complaints concerning formulations proved unfounded, as the active ingredient contents were correct. These included samples of lime sulphur, ethylene dibromide, lysol, barban, and melprex.

WATERS, REGULATORY AND GENERAL SECTION

Waters

The Water Testing Service.—This continued in strong demand, and 5,263 samples were tested. Extensive use of the facilities in Regional centres, as well as at the main Rydalmere laboratory was made by landholders, the Water Conservation and Irrigation Commission, bore-sinking contractors and other commercial and industrial organizations. Many of the samples were tested at country centres.

This partial decentralization has especially assisted landholders. In most cases they have been able to get prompt personal attention by local officers familiar with the environment. At the same time this has reduced the number of samples and enquiries handled at Rydalmere and allowed more detailed attention there to problem waters, development of new test procedures (e.g., the recently introduced nitrate test), training of regional officers, and specific research.

The regional testing services' value is shown by the following extracts, sampled from Regional Supervisors' reports:

> *Maitland*: "Most of the samples (282 at Maitland) were from new irrigation projects being developed by farmers. In drier months a lot of the samples were from the tidal reaches of the Hunter River."
>
> *Cowra*: "Some 400 samples were tested, about double the usual annual total here. The continuing drought conditions caused farmers to seek analysis of water resulting from search for underground sources. Some samples were because of suspicion of water at low level in normal farm storage systems."
>
> *Barham*: "The increase to 438 samples tested here was caused by extensive ground water and deep boring work in the district. Severe drought, perhaps the most ever in this district, was experienced. The water testing equipment was invaluable as an extension and service aid to the farmers."

The large number of samples handled in some Regions has placed a severe strain on personnel already heavily committed in other aspects of extension work.

Officers from Rydalmere continued to visit the Regional centres to check and service equipment, and to brief extension personnel on test procedures and interpretation of results. Areas visited this year were Tamworth, Gunnedah, Wagga, Barham, and Dareton.

Conferences and Lectures.—Waters Chemist Mr M. G. Chatfield, attended by invitation a conference set up by the Sunraysia Salinity Committee at Mildura, to advise on salinity standards and the problem of salt damage to crops irrigated from the Murray River. This subject was the basis also of an address delivered at a meeting of the Australian Water and Water Wastes Association.

The Section provided also a talk to the Gosford Broiler Growers' Association on water testing and water quality for poultry.

Waters Research.—The soil moisture blocks used successfully to determine irrigation need of crops have undergone further testing in trials at Gundagai concerned with asparagus growing.

These blocks developed by an officer of this Section, in conjunction with a commercial organization, are placed in the active root zones and positively indicate soil moisture status and stress conditions.

The Co-operative which has installed these blocks at Gundagai has reported that asparagus fern growth and general vigour were superior in the plot irrigated by indication from the blocks, and that this was due to the response immediately irrigation was applied.

Analysis of Stockfeeds and Medicines

With Division of Animal Industry, quality of stockfeeds manufactured by the larger mills in the Sydney metropolitan area was surveyed to check conformity with the manufacturers' guaranteed analysis. No gross divergence from the registered analysis was found.

A number of products were analysed because of complaints by consumers. Among complaints substantiated by examination were:

(i) Ineffective control of salmonellosis and other poultry infections by a concentrate containing furazolidone as active ingredient. Analysis revealed that the product contained only one-fifth of the amount of active ingredient stated in the registered formulation.

(ii) Death of a number of pigs followed use of a particular mineral supplement. Examination revealed incompatibility of ingredients, resulting in uneven distribution of the various trace minerals in the formulation.

(iii) Adulteration of molasses for sale in the Goulburn district. Analyses showed a higher water content than is reasonable in genuine molasses, with consequent low nutritive value and greater susceptibility to fermentation.

Appropriate action was taken in each case to ensure that future supplies of the product conform with the guaranteed standards.

An officer of the Section attended further committee meetings relating to amendment of the Stock Foods and Medicines Act. The Act has been completely reviewed and brought into line with current knowledge of all aspects of stock health and nutrition. A draft is now to be submitted to the Legal Officer.

Indian Standards Institution Assisted

The Indian Standards Institution asked for comments on their draft standards for coconut meal, cottonseed meal and rice bran. The comments made included suggestion of modification of the standard for fat content of the solvent-extracted meals.

Collaborative Projects on Feedstuffs

Analytical work on two projects in collaboration with Seven Hills Poultry Research Station officers has been completed. These projects are:

(i) *Survey of Australian Feedstuffs*.—Over 200 samples of the main stock feed ingredients have been analyzed for major and minor elements as well as protein, fat, moisture and ash. The survey has indicated some significant differences in composition between products of Australian and American origin. Results have been tabulated in preparation for publication with relevant text.

The publication should be of major benefit to workers in nutrition and feed formulation in the livestock industries. They have had to rely on overseas figures in many cases.

(ii) *Choline in Poultry Diets*.—Investigations aimed at establishing optimum levels of choline in broiler diets have been completed.

Choline is an important nutrient, necessary for growth, bone development and fat metabolism. This project is a significant contribution to poultry nutrition knowledge.

One paper highlighting some of the findings has already been published in the *Australian Veterinary Journal* and a second paper is in preparation.

Oils and Fats

An additional chemist has been appointed, for specific studies in the field of oils and fats. Development of new analytical methods and equipment to examine the composition of these materials has resulted in new gas chromatograph and thin-layer chromatographic apparatus at Rydalmere.

Quantitative estimation of the composition and source materials of margarine, controlled by regulations under the Dairy Industry Act, will be undertaken.

The equipment has already assisted examination of a dairy spread recently introduced on the Australian market. Although based on milk solids and butterfat this product contains much less fat than does butter or margarine. If the spread gains general public acceptance the overall consumption of butterfat would be less; as by the trend in America. This would affect the dairy industry.

Gas chromatographic techniques are to be applied also to study of the fatty glyceride composition of varieties of oilseed crops rapidly assuming importance in New South Wales primary industry.

PHYSICAL CHEMISTRY SECTION

Free Energy and Soil Potassium

Data from free energy measurements related to the potash research programme of the Chemistry Branch have been processed and studied. The interpretation has been completed and a report prepared as a basis for deciding the course of further action. This report is being studied by the project committee.

Large Spectrograph Analyses

Rock Phosphates.—Analyses of rock phosphate samples for trace elements were completed. Each source of rock phosphate is characterized by certain levels of other impurity elements. The trace elements were detected by using the large spectrograph. None appears to be in sufficient concentration to effect a crop through superphosphate application.

Miscellaneous Materials.—Some miscellaneous samples were analysed quantitatively for trace elements. One was a suspect bottle of Calcium carbonate. On analysis on the large spectrograph this failed to reveal any inorganic elements, not even calcium. The sample was later found to be phenacetin.

Atomic Absorption Spectrophotometry

Rock Phosphate and Superphosphate.—The work on samples for Ca, Mg, K, Na, Mn, Cu, Zn was completed. Only zinc appears to be in sufficient quantity to cause any field effect when superphosphate is used as fertilizer. Each source rock has a certain level of zinc. This is very high for Nauru rock and low for Florida rock.

Plant Samples and Soil Extracts.—About 3,000 plant samples were analysed for Ca, Mg, K, Na, Mn, Cu, Zn elements, and a number of soil extracts in barium chloride were also examined.

Improvements to the Instrument.—These have increased the efficiency and output. The digital indicator unit and a digital printer, the latter printing on paper tape the sample number and concentration (in p.p.m.) in solution, have been an outstanding success. Speed of analysis on the instrument has been doubled and most of the calculation work on the results has been eliminated.

A new zinc high intensity lamp was acquired. This was because the signal from the old hollow cathode lamp was inadequate for the digital indicator unit's photomultiplier supply voltage. Sensitivity increased markedly. Previously, for 1 per cent transmission the equivalent zinc concentration was 0.04 p.p.m. and for 4 p.p.m. the per cent transmission reading was 38.0 per cent. Now the respective value is 0.02 p.p.m. and 6 per cent.

PLANT NUTRITION SECTION

Corrosion in Vegetable Canning

Following an approach by Australian Iron and Steel Ltd for co-operative work on a problem of corrosion associated with canned vegetables, a trial was designed by the Chemistry Branch and commenced by the Division of Plant Industry at Hawkesbury Agricultural College.

The trial was designed to study beans before and after canning, for the effect of applying varying quantities of nitrogen. Australian Iron and Steel Laboratories have canned beans harvested from the trial and are holding some of the samples for nitrate analysis.

Certain types of detinning in canned foods appear to be more frequent over the past 3 to 5 years. Unusually high levels of nitrate in the vegetables are suspected as a possible cause and this might reffect fertilizer treatment. The experiment in hand will test this theory.

Citrus Nutrition Research

Sampling in the Gosford area has proceeded for 4 years. The outcome material have been prepared for Automatic Data Processing. Some sample runs are available but comment on their value would be premature.

The growers whose orchards have been sampled are using lower fertilizer rates than before the 4-year sampling started. 1 lb N, 1 lb P_2O_5 and ½ lb K_2O has been the recommendation for the test orchards. No rise or fall in production has been observed during the period although this would be difficult to establish in the type of experiment; there has been a drop in leaf nitrogen and a drop in phosphorus; sodium levels are stable, and there has been a slight increase in magnesium.

A most significant but unexpected change in nutrient levels has been in relation to calcium. Calcium has fallen over the 4 years, on all orchards, and appears in this fourth year to be approaching danger level. The cause is not quite clear but if the trend continues next year action will be taken to restore calcium levels.

In recent years there has been a swing to high analysis fertilizers which contain less calcium. Also, in recommendations made to the growers in the experiment, there has been an absence of lime, largely because of the effect of high pH on *Phytophthora* incidence and at the same time a need for magnesium in the soil. To incorporate magnesium into the tree a simple magnesite dressing has been recommended in instances where the magnesium levels are low in the leaves.

Citrus Leaf Analysis

At the 1968 Horticultural Research Conference at Mildura, State Departments differed as to the leaf chosen for assessment of the nutritional status of oranges. The 4- to 7-months-old spring flush leaf sampled in late summer was common to all workers but were sampled from two types of shoots, fruiting and non-fruiting.

In 1965 at Yanco and in 1968 at Gosford flush leaves from both types of shoots were studied.

Significant differences were found in the nutrient levels of the two types of leaves. Nitrogen, phosphorus, and potassium were lower and calcium higher in leaves from fruiting wood. Part of this difference is accounted for by different standards proposed by American workers for the two types of leaves. H. D. Chapman has proposed a set of standards for leaves from fruiting terminals. Reuther, Embleton, and Jones, and other workers, have proposed slightly different standards for leaves from non-fruiting shoots.

The samples from the 29 Gosford orchards fell into various categories of deficiency (low, satisfactory, high, or excess) based on the two sets of standards applied to the appropriate type of leaf and a classification using a standard tentatively established by this Chemistry Branch.

It was evident that quite a different assessment of nutritional status of orchards in the Gosford district results from selecting leaves from fruiting shoots, compared to this Branch's normal practice of using non-fruiting shoots. Differences in standards proposed for the two types of shoots do not compensate for the large differences in leaf levels between the two types of leaves.

Obviously, adoption of a uniform system of sampling by workers in all States is important.

Magnesium Trial on Citrus

In field trials of various rates of magnesite, on several orchards, no improvement has been detected in the trees. Magnesite soil dressings have been applied for 4 years to correct magnesium deficiency. Leaves have been analysed at regular intervals after soil applications. The analyses show that the young spring leaves take up the magnesium from the soil dressings within 6 months. But over the 4 years there has been no visual indication of this uptake in the tree.

As a result of this work it has been customary to recommend both a soil dressing and a spray of magnesium nitrate each year, where magnesium level is low in the leaves. The spray gives immediate correction on the tree but the effect does not last for a whole year. A small soil dressing of magnesium carbonate yearly in such circumstances helps to restore gradually the tree health whilst the main symptoms of the old leaves are corrected by the spray.

Studies of Nitrates in Plants

Over the last decade, nitrates have received increased attention. They affect such widely diversified aspects of agriculture as nitrate intake and animal performance, cotton fertilization, canned vegetables, and so on.

Fertilizers have been blamed for the accumulation of nitrates, at least in part. Recent years have seen spectacular rise in nitrogen fertilizer usage, with high application rates and increasing supplementation of legume nitrogen by bagged nitrogen.

Nitrate accumulation in the plant is to some extent a normal phenomenon. Most plants take up nitrate preferably to other forms such as ammonia. Nitrates are typically converted within the plant to amino-acids and proteins by reduction and combination with products of photosynthesis. Drv weather, shading or other factors which retard photosynthesis, deficiencies of molybdenum or other elements affecting the nitrogen metabolism of the plant, or too much fertilizer nitrogen, can all result in nitrate accumulation.

Officers of the Plant Nutrition Section are co-operating in a number of projects wherein nitrates in plants are of major importance. These include studies on the effects of fertilizers on nitrates in canning beans (described earlier), chemical factors involved in differing performance of sheep grazed on several pure pasture species, nitrate accumulation in pasture and forage from fertilizer trials, and the development of nitrate levels in the petiole of cotton as a measure of nitrate needs.

It became a matter of urgency to test and develop reliable and rapid analytical methods to determine nitrates in plant samples. A full examination of methods has recently been completed and a reliable method established.

A literature survey revealed three main approaches, with many variations of method within each. The three are: (a) direct colorimetric determinations on the nitrate ion; (b) reduction to nitrite followed by colorimetric determinations; (c) reduction to ammonia which is then determined colorimetrically or by titration.

Early investigations centred on direct colorimetric determination of nitrates but an exhaustive exploration of several techniques showed that none was reliable enough.

Excellent results have been had with firstly a micro- and latterly a micro-technique involving reduction of nitrate to ammonia, followed by titration. Ammonia nitrogen, where present, can also be determined in the one digest. An accuracy of ± 1 per cent is obtainable but there is still scope to improve the speed. At present ten samples per day can be analysed.

A still more rapid method now appears possible, using a nitrate electrode. Tests with this equipment, from the University of Sydney, indicate the method's promise. The work is continuing and necessary equipment is being sought.

Manganese Toxicity

A number of lucerne and soil samples from southern districts have been tested for manganese toxicity. The lucerne plants normally contain 30 to 150 p.p.m. of manganese but through the summer months there have been instances of manganese toxicity. Some plants contain as much as 2,000 p.p.m. manganese.

Comparison of two separate conditions under which manganese toxicity occurs in New South Wales is interesting. On the far north coast, on red soils, manganese toxicity in beans is high and is generally a function of soil acidity. It occurs in the winter and has not been reported in the summer.

On the southern tablelands, in lucerne, manganese toxicity occurs under dry hot conditions. The soils may not be so high in natural manganese but after a hot dry summer may be partially sterilized. Bacteria, which convert the soluble forms of manganese to the insoluble tend to be sterilized in hot dry soils. Thus, soluble forms of manganese continue to build up in the soil and become toxic to the plant.

Both types of manganese toxicity can be corrected by heavy lime dressings of one to two tons/acre.

As a sequel to the Terranora work (far north coast) with beans, it was decided in co-operation with Division of Plant Industry that both plant and soil samples from about 50 vegetable growers would be analysed annually. This is firstly to assist the growers in relation to problems associated with manganese toxicity, and secondly to enable the Department further to assess the problem.

Nitrogen Nutrition of Cotton

In co-operation with a research agronomist at Narrabri Agricultural Research Station extensive field trials have been conducted in the Namoi cotton producing area to test the relationship of plant, fertilizer, and soil nitrogen to yield.

Difficulties related to chemical analysis needs hampered this project early but have now been overcome. A backlog of some 1,000 samples from the 1965–66 and 1966–67 seasons is being cleared before the 1967–68 sampling begins.

These field trials and associated work should cease at the end of the 1967–68 season. The results will be ready for statistical treatment by mid-1969.

Slow Release Fertilizer, Magnesium Ammonium Phosphate

A magnesium ammonium phosphate is one of the several synthetic slow release fertilizers which in recent years have been placed on the market (mag-amp). It is relatively insoluble and release of available nitrogen depends on particle size.

In theory these materials release their nutrients at a steady rate parallel with the crop's needs, thus ensuring efficiency of usage and the prevention of burning. It is now generally realized that injury can be serious if these materials are not used correctly. A disastrous case was inspected in January, 1964, on a Castlereagh property. Nearly all of 600 young citrus trees were dead or damaged as a result of the fertilizer having been placed in the planting hole. Damaged strawberries and other crops have been brought in from time to time.

A pot trial was conducted in the Chemistry Branch glasshouse, using citrus seedlings and placing the fertilizer in the pots at usual and at higher rates. Results confirmed field observations at Castlereagh. Growth was best in the pots without the fertilizer. All plants treated with it showed degrees of injury according to rate of application, fineness of grinding and placement. Many plants were killed or badly injured.

Placement had the greatest effect. Mixing the fertilizer through the potting soil was more damaging than a double rate placed away from the roots.

These results and reported damage show that users should not over-estimate the non-burning potential of controlled-release fertilizers.

Also, the expirenece has helped to confirm that placing a fertilizer of any form *in the planting hole of citrus trees* is very hazardous.

Zinc Definiency in Maize

Further glasshouse and field work was done on zinc deficiency in maize. New types of wetting agents and surfactants have been tested and have dramatically improved the effectiveness of zinc oxide spray. Zinc oxide in the absence of a suitable wetter had little or no effect on the correction of zinc deficiency. Zinc sulphate, effective without a wetting agent, is also improved by wetters.

There are still problems in correcting zinc deficiency on alkaline soils, and leaf analysis is not always closely related to degree of deficiency.

Overseas literature indicates that zinc is immobilized under conditions of alkalinity, possibly as zinc phosphate or some other insoluble compound in the roots and nodes of plants.

Further attention is being given to locating zinc in plants grown on alkaline soils, such as the soils of the Northwest. Radioactive zinc may be used in pot experiments to study (a) the exact location of tagged zinc within the main plant and (b) the form and availability of zinc within the plant.

Proposed Soybean Nutrition Work

Soybeans have potential for the Northwest. They would be used in a rotation of two crops per year (for example, wheat in the winter and soybeans in the summer) if it is shown that they can be successfully grown.

On two properties about 30 miles apart in the Quirindi-Breeza district, one grower achieved 40-50 bushels of soybeans/acre whereas the other grower achieved only 10 bushels/acre. Each is a leading farmer. On one property there were signs of nodulation and lime-induced chlorosis, although zinc deficiency did not appear to be sole cause of plant unthriftiness.

Samples from these properties have been collected, potted up, and planted to soybeans. The plants are growing in the glasshouse.

In summer, field trials will be planted to investigate nutritional requirements of soybeans on a typical soil of the Breeza district.

Soybeans are, of course, influenced by day-length, with considerable varietal differences in this respect. But there might also be such differences in susceptibility to mineral deficiencies.

Nitrogen in Mushroom Compost

The total of established mushroom growers in New South Wales has grown considerably. Following conferences in October, 1966, and July, 1967, and as a result of mushroom growers' study tours overseas, there have been more critical looks at the nitrogen levels of compost. A publication of the U.K. Ministry of Agriculture, Fisheries and Food (Bulletin 34), suggests that nitrogen levels of mushroom compost should be 2.0 to 2.2 per cent. Barton, in a recent article in *World Crops*, stressed the three important factors measurable by analysis which contributed to optimum yield: an optimum moisture content of about 70 per cent, a pH of 6.8–7.5, and a nitrogen content of 2.0–2.7.

Since 1965, growers in New South Wales have submitted to the Chemistry Branch about 600 samples of compost for nitrogen, moisture, and pH determinations. The range in nitrogen content was from less than 1 per cent to over 4 per cent, in pH from 4.8 to 8.5, and in moisture from 33 per cent to 81 per cent.

These ranges are very wide. It would seem that many of the composts were far from supplying optimum conditions for mushroom production. Growers are only now realizing need to control compost quality by means other than "rule-of-thumb".

As a result of Chemistry Branch work on mushroom compost, and the advice of officers concerned, most growers are now preparing their compost with a desirable nitrogen content within the range of 2.0 to 2.7 per cent and also maintaining pH between 6.8 and 7.5 by using appropriate quantities of lime.

Diagnosing Mineral Deficiencies

This year some 31,200 analyses were carried out on 5,942 plant samples, for diagnosis and research; 4,300 more than in 1966–67. Field officers have found the diagnostic services particularly valuable.

An extension article was published in the June, 1968, *Agricultural Gazette of N.S.W.* explaining the uses and limitations of the diagnostic work. A bulletin including 40 colour plates to assist in recognition of deficiency symptoms is in final stages of preparation.

Chloride Toxicity

As a result of drought, chloride toxicity has been reported in a number of southern areas. Normally, chloride toxicity would not be expected in the coastal and tableland areas of this Region, but in the Bega district, on the South Coast, white clover samples have been found to contain as much as 2.5 per cent chloride and 1 per cent sodium. These levels are quite lethal to the plants. White clover plants would generally contain less than 1 per cent chloride and less than 0.01 per cent sodium.

In the prolonged drought, chloride and sodium levels have accumulated in the root zones of the growing plants. It may come from salty irrigation waters or it may be concentrated in the root zone solely through lack of leaching of the soil profile. Outbreaks of high plant chloride levels is a common feature of regional droughts.

Determining Elemental Sulphur in Sulphur-Fortified Superphosphate

To study the fineness of fortified superphosphates, a rapid method for handling the needed large number of determinations of elemental sulphur had to be developed. The old one was laborious. It required, first, the determination of the sulphate sulphur then oxidation of the elemental form.

A simple and accurate method was developed by adapting the Soxhlet procedure normally employed to extract fats from feedstuffs. Little modification was needed other than replacement of ether, the fat-extracting solvent, by carbon disulphide, the sulphur solvent.

This has given very reliable results when used for sulphur-fortified superphosphate made by either wet or dry mix methods and for elemental sulphur fractions extracted from sulphur-fortified superphosphates.

SOILS SECTION

Soil Testing

Over the last few years farmers' interest in soil testing has increased. The totals of samples analysed by the Department and commercial testing services have risen steeply. In 1967–68 there was a 50 per cent increase over the previous year in the Soils Section and a similar increase can be expected in 1968–69.

An element of "competition" has come with the recent entry of several fertilizer firms into soil testing. Australian Fertilizers Ltd, Austral Pacific Fertilizers Ltd in northern N.S.W., and Cresco Fertilizers, a Victorian firm, in southern N.S.W., have set up soil testing services. In this situation there is increased publicity for soil testing, associated with promoton of fertilizer sales, and increasing need to make clear to the farming community the true value of soil testing.

Much of the research by this section of the Chemistry Branch aims at evolving reliable soil chemical tests for diagnosing deficiencies of plant nutrients and toxicities of some elements, as a basis for recommending rates of appropriate fertilizer or soil amendments.

Steady progress is being made with soil tests for phosphorus in wheat soils. Progress with potash and phosphorus tests for pasture soils is less satisfactory because of difficulty in obtaining sufficient field fertilizer trials. These are a necessary part of the development of any soil tests.

Advisory Soil Analysis

This work further expanded this year. Samples handled totalled 3,994 (51.4 per cent more than in 1966–67) and the reports totalled 676 (26 per cent more than in 1966–67). Additional work also was done pertaining to water permeability problems occurring in new irrigation projects.

There has been more work in the section this year in diagnosing unsatisfactory plant growth. In many cases the reason was excessive salinity or acidity, or imbalance of nutritional elements, or manganese toxicity.

In the course of streamlining methods to increase output, the estimations of potassium, sodium, calcium, and magnesium have been undertaken 400 at a time instead of 20.

Potassium Survey

The method for determining non-exchangeable available potassium (N.E.A.P.) reported in the 1966–67 Annual Report was tested further for reproducibility, and apparent sources of inefficiency were investigated.

Planning of the pilot survey to determine available potassium levels in the South Coast and Tablelands Region was continued. Circulars and sample questionnaires were prepared after consultation with the district and research agronomists and with representatives from Division of Plant Industry and Biometrical Branch. Compilation of a list of properties for use in the survey is in hand.

Soil Manganese Work

At Terranora. A report of results of the 3 years' trial (1964–66) has been drafted. Biometrical analyses have not been completed.

At Alstonville. 1967 was the first year of the manganese trials at the Tropical Fruit Research Station. Analyses of the soil and plant samples have been completed. Some unknown factor damaged the winter bean crops in both the "correction" and the "chloride effect" trials. Thus, satisfactory conclusions cannot be drawn from these first crops. Also, in the chloride trial the *Glycine* seeds did not germinate in the winter and resowing was undertaken in November. Vetches were also very poor and unsuitable for experimental work.

The results of analyses, however, show that magnesium carbonate and dolomite have corrective effect similar to lime, by increasing the pH and lowering the soil manganese content. The changes in pH and manganese are less pronounced than they were in Terranora soils, where the initial manganese content was much higher and the soils more acid.

Application of sulphate of ammonia did not seem to have any acidifying effect in the first year. In contrast to the correction trial, in the chloride trial wherein four levels of KCL were applied the manganese content increased gradually towards the end of the year with higher chloride rates. The increased manganese levels in the soil were not reflected in higher manganese levels in the bean samples.

Manganese Soil Test. A pilot soil-test scheme for manganese in bean soils of the Tweed area commenced last year. Some 40 soils were analysed before the winter bean planting and lime was recommended where required. Leaf samples are to be analysed from the same crop.

Manganese Test for South Coast and Tablelands Soils. Soil samples from the Goulburn area where soil manganese reached a high level during the long, hot, dry summer were analysed. Accumulated manganese affected young lucerne plants where high rates of superphosphate were applied to improve the pasture. The determinations for aluminium were also made.

Citrus Soil Work

Soil samples were collected from six selected citrus groves in the Sydney and in the M.I.A. areas. The Sydney samples were those collected also for the magnesium deficiency trial.

The Sydney samples and about half of the M.I.A. samples have been analysed. All of the major and most of the minor nutrition elements, and the pH, salt content, organic matter, and soil texture were determined. And mechanical analyses were done.

Samples from the Sydney area's magnesium deficiency trials show that the soils responded to magnesium treatments in the 0 in–6 in top layer and to some extent at the 6 in–12 in depth. However, the proposed magnesium content of these soils had no immediate effect on the magnesium content of the citrus leaves.

Analytical work on the citrus soil samples is now in arrears due to the shortage of laboratory assistant staff. Further examination of the relationship between soil and leaf analysis results therefore could not yet be undertaken.

Soil Surveying

Visit to Victoria.—The Soil Surveyor visited in mid-1967 Mr R. K. Rowe of the Victorian Soil Conservation Authority at Wangaratta for a week's tour of that district to examine profiles and groundsurfaces. The general sequence was found to be as at Grafton but many of the individual profiles were different in gross character. There were discussions also on submission of papers to the Ninth International Congress of Soil Science. Such exchange visits are valuable for rapid correlation of groundsurface series and profile members.

Rapid Soil-Landscape Appraisal Method.—Success of rapid soil-landscape appraisals has been in no small measure due to the help freely given by Dr D. C. van Dijk of the CSIRO and Mr R. K. Rowe of the Victorian Soil Conservation Authority in the survey conducted by the Chemistry Branch Soil Surveyor Mr A. Riddler in the Mid Clarence Valley.

Dr van Dijk provided the initial theory on which the survey technique was built and Mr Rowe provided the much needed regional correlation in profile members on the groundsurfaces. For example, many of the soils encountered in the Southern Region are identical with those demonstrated by Mr Rowe in the Victorian Upper Murray Catchment.

It is noted, however, that major differences in the groundsurface distribution do occur on either side of the Murray River, the soils being generally older in New South Wales; i.e. there is a larger outcrop of an older groundsurface as compared with the larger catchments on the Victorian side of the Murray.

Mid-Clarence Valley Projects.—In an exchange visit during December, 1968, Mr Rowe visited the Mid-Clarence Valley for a week. He examined the groundsurface sequences, distribution and profile members, and was able to impart valuable information on colluviation and associated microphysiographic phenomena, soil classification and behaviour and land use.

This information was of immediate use and will add to the quality of the final report. At present all results are being processed in preparation for A.D.P. retention and recovery. Copies will be available to interested research workers.

Field studies in the Mid-Clarence Valley in November to December, 1967, and April to June, 1968, completed a stage of research into the genesis, form and distribution of the various soils. They established the correlation between geology and topography, and the effect of this on groundsurface distribution and preservation and the suites of soils resulting.

Historically and scientifically it is interesting to note that this work is a logical extension of the ideas set down by H. I. Jensen in his *Soils of New South Wales* (N.S.W. Government Printer, 1911) where he stated that none of the North American or European systems worked here and that soil properties depended on geology, topography, transportation and degree of leaching.

The present studies in the Mid-Clarence Valley confirm that statement. The work is a systematic quantitative extension of certain of the questions originally posed by Dr Jensen.

RICE CHEMISTRY

Soils Advisory Samples

Soil samples taken by Australian Fertilizers Ltd for rice advisory service were analysed early this year. Results agreed with those obtained by the Australian Fertilizers Ltd laboratory. However, many figures were much lower than those from similar sites in previous years.

Check samples taken by Departmental field assistants were found to give results consistent with previous experience. Later it was found that oil used to lubricate the sampling tools, during the original Australian Fertilizers Ltd sampling, caused a drop in the exchangeable ammonium figure used for advisory purposes.

Following that finding, an investigation of sampling tools has shown that a spade or larger diameter tube gives more satisfactory results and does not need use of lubricating material.

Field Sampling of Fertilizer Trials

Soil sampling of a number of fertilizer trials conducted in the district by the rice agronomist was carried out from sowing until mid season (end of December). These showed high levels of ammonium nitrogen after sowing, consistent with the rates of ammonium fertilizer applied. The levels showed a steady decrease during the weeks following sowing until, by the end of November, most plots were giving a level of about 5 parts per million.

Plant analysis showed that by late December only about one-quarter or less of fertilizer nitrogen had been absorbed by plants. Plant samples taken at harvest gave similar results; in some cases somewhat higher than mid-season results. Plots treated with the highest fertilizer rate of 140 lb nitrogen per acre did not reach a minimum until mid-December.

Experimental

Two small-scale trials were conducted at Yanco: (i) Rice, a time-of-application trial; (ii) Cotton, a nutrition trial.

Nitrogen, Time-of-Application to Rice.—Nitrogen applied at mid-season was found more effective than when applied at sowing. It gave higher yields of grain for the same total of nitrogen used.

Cotton Nutrition.—Seed cotton yield was found to increase steadily with amount of nitrogen supplied; up to the highest treatment rate of 200 lb nitrogen/acre, other nutrients not being limited.

Phosphate treatments at rates of 4 and 8 cwt superphosphate/acre gave nearly equal yields. There was appreciable increase in yield for the higher phosphate rate when combined with the highest nitrogen rate.

These results indicate that nitrogen for cotton crops could be deduced in a similar way, from the incubated ammonium figure used for rice soils advisory work. Phosphate would not be limiting on most soils provided water penetration of the soil were adequate.

Determining Incubated Ammonium

Comparison of the method of determining incubated ammonium used at the Department's Yanco laboratory and the modification adopted by Australian Fertilizers Ltd had shown a difference in results, particularly at the top end of the scale.

Australian Fertilizers Ltd was finding, in this range, results higher than the Yanco laboratory figures—by 10 to 20 p.p.m. Investigation showed this to be due mainly to the amount of soil incubated. Yanco was using 30 g and Australian Fertilizers Ltd only 5 g of soil.

Number of Nitrogen Applications per Rice Crop

The rice chemist has emphasized this year that the rice crop needs two applications of nitrogen fertilizer as described in the Advisory Scheme proposed by him in 1963. This has been supported by several years of experimental work at the Yanco Research Station and by small-scale field work. It has also been confirmed in this year's field trials, by the relatively small increases in grain yield (in many trials ½ ton or less/acre) from any rate of fertilizer nitrogen up to 140 lb/acre; particularly since 140 lb of nitrogen is enough to give a yield of 4 tons grain/acre without any soil nitrogen.

Dairy Chemistry

The dairy chemist position had been vacant for some time. Therefore priority has been given to examination of various analytical procedures for dairy products. This is with a view to finding the most practicable and reproducible procedures. In some cases slight modifications have been introduced.

Moisture Distribution in Butter

Work is being done at this time on a method to determine the moisture distribution of butter, as a guide to the working conditions of the buttter churn.

Butter Survey

A country butter survey was done, wherein only the moisture and salt analyses were attempted. From the experience gained it is apparent that the less refrigeration given the samples the more reproducible the results.

In future the butter samples, if numerous, will be kept at 20°C until tested, as the temperature of the refrigeration induces hydration and also subsequent concentration of salt in the aqueous phase. In future surveys, extraneous matter and moisture distribution tests will be added to the current range.

General

A school on thin layer chromatography and electrophoresis was attended by the dairy chemist. Possible applications of these methods to dairy industry problems are many and varied.

The dairy chemist also visited the CSIRO Division of Dairy Research in Highett, Victoria for information on various processes and products and for useful liaison with officers of that CSIRO Division. Also whilst in Melbourne the chemist had discussions on dairy products analytical methods with the Dairy Technical Services and officers of the Gilbert Chandler Institute of Dairy Technology at Werribee.

The dairy chemist also lectured in basic chemistry (35 hours of lectures) where stationed, at Hawkesbury Agricultural College.

DECENTRALIZED AGRICULTURAL RESEARCH DIRECTORATES

Agricultural Research Institute, Wagga Wagga

WHEAT IMPROVEMENT

Yield Trials

Despite the 1967 crop year being the driest on record for many parts of the region, wheat crossbreds and varieties were usefully assessed for yield.

Gamenya proved to be well adapted to the regime of late sowing-early ripening and the hardiness of Heron and Robin was evident. Robin has been widely distributed throughout Australia for, in 1968, its first commercial sowings.

Olympic and other late crossbreds were generally poor in yield. The new variety Timgalen was invariably poor yielding.

A.R. Falcon 28A the new, rust resistant crossbred with Falcon type quality consistently yielded as well as Falcon. This supported its general superiority over Falcon as noted in the more favourable conditions of 1966. It will continue in Farmer Experiments and pure seed stocks are being increased in anticipation of the naming and release. Less advanced semi-dwarf rust-resistant Falcon lines are now being widely tested. Various degrees of winterness are also being incorporated.

Two lines with impressive records, the mid-maturing G.G2 Pinnacle M.1224 and a high quality semi-dwarf M.1238–2, were also promoted to Farmer Experiments. For yield and quality each is an advance on varieties they would be likely to replace, respectively Olympic and Falcon.

Semi-dwarf Wheats

The crossbred N.B.J. 115, from Norin-Brevor-Javelin crosses made in 1956–57, again performed creditably and steps have been taken towards naming and release. In four years of dry land tests N.B.J. 115 has been significantly superior to Olympic on 36 occasions, equalled it on 34 and inferior on 10 occasions. Under irrigation it has always been equivalent or superior to Olympic. The crossbred, which is comparable in quality with Olympic, is designed for the more fertile and higher rainfall regions of the Southern Wheat Belt. It shows distinct promise for the irrigation areas as well.

A crossbred from Mexico designated W.W.15 has done exceptionally well; 105 bus/acre under irrigation at Coleambally in 1967. It also has good milling and baking quality and is resistant to several races of stem rust. Backcrossing and mutation procedures to convert its grain colour from red to white have been started.

N.B.J. 115 and W.W. 15 have been submitted for inclusion in the Rockefeller Foundation International Yield Trials.

Investigation of the physiological basis of yield superiority of the Mexican semi-dwarf wheats has revealed at least three potential sources; improved resistance to lodging, increase in the setting of grain, and lengthening of the period of grain growth through earlier flowering. Analysis of developmental response showed European varieties to be more and Mexican varieties less sensitive to daylength than are Australian wheats. There are consequent important effects in their reactions to various times of sowing.

Disease Resistance

Selections have been made for resistance to flag smut and stem rust, and further crosses to incorporate resistance to *Septoria tritici* were made using parents with a history of freedom from this in New South Wales and New Zealand.

Leaf frosting in September, 1967, was the most extensive yet seen but had little relation to final yield. Heron was one of the worst affected and yet was the highest yielding.

Tests for powdery mildew resistance were undertaken for the U.S.D.A. Uniform Mildew Nursery. Several outstandingly resistant lines were selected.

Hybrid Wheats

Investigations basic to introducing hybrid wheats to Australia have been in progress for several years. Male sterile lines of Heron and Triple Dirk have been produced and possible fertility restoring mechanisms are being examined. From natural cross pollinations on to male sterile lines in 1967 this phase of a hybrid wheat programme seems likely to present definite practical difficulties.

Genic male sterility is being further analysed.

Phasic Development

Day length sensitivity and responsiveness to cold temperature vernalization continued to be studied. Chromosome substitution methods have been used to identify specific chromosomes associated with this behaviour.

Identification of one of the component "winter" genes of Winter Winflor within the spring variety Thatcher has been of special interest. Further studies, using isogenic lines, have been undertaken, towards evaluating the role of major genes relative to adaptation of varieties to the Australian wheat belt.

Afghanistan Wheat Collection

Taxonomic classification, character descriptions, and seed multiplications are proceeding. Evidence secured by Dr W. V. Single of the Agricultural Research Station, Tamworth, suggests that a superior form of frost resistance has been obtained in this collection.

Wheat Cytogenetics

Alien Additions.—The seven addition lines of *Secale cereale* to the variety Heron have been verified on plant morphology and karyotype identification. The R. Riley (Cambridge) descriptions of Holdfast-King II rye additions were used for comparison. A number of telocentric lines have also been assembled.

Crosses have been made between Olympic, Robin, N.B.J. 115 and *Agropyron caninum*. The objective is to add to these wheats *Agropyron* choromosomes bearing some of the *Ophiobolus* resistance possessed by *Agropyron caninum*.

Monosomic Lines.—The fourth backcross in a Heron monosomic series has been achieved. The fifth backcross in a Falcon monosomic series has been achieved, and monosomic lines and breeding behaviour have been described.

Triticale.—A worldwide collection of *Triticales,* hexaploid and octoploid, has been made. Initial evaluations and seed multiplications are proceeding. Examination of the potential value of the hexaploid *Triticale* as a grazing cereal has special interest.

A number of crosses between a locally adapted durum wheat (Dural) and four rye species also have been made. This is an attempt to exploit wide variation in *Secale,* for possible use in hexaploid *Triticale* grazing types.

Wheat Quality Investigations

The scope of routine quality testing of plant breeders' material has been widened by introducing micro milling and baking of early generation lines.

Analysis of loaf characteristics of samples baked by the normal procedure had in previous years indicated that satisfactory quality screening would be possible on the basis of loaf volume only, provided hard and soft wheats were heated separately. A supplementary grain hardness test has been used to segregate the two types.

In developing the new techniques every effort was made to combine speed and ease of testing with sensitivity in differentiation of major quality characteristics similar to that of the normal test-baking procedure.

Contrary to the original intention that this test should serve only as a coarse preliminary quality screen for early generation material, experience has shown that a good assessment of other loaf characteristics such as maturity and crumb texture can be made. This permits finer differentiation of material of similar type, as well as the detection of lines with obvious quality defects.

This new test achieves the longstanding objective of replacing small-scale empirical quality prediction tests used formerly by the wheat breeder. It also shows promise as a useful tool in the Institute's quality research programme where material possessing specific quality characteristics is often very limited.

OAT IMPROVEMENT

Variety Trials

Because of the exceptionally harsh drought conditions all grazing oat variety trials failed. For some the sowings were not even attempted. The persistent dry weather also delayed the sowings of the ungrazed oat variety trials 3 weeks beyond their usual sowing date in mid-May.

Good performance of the crossbred Avon x Osage was the 1967 highlight. It was significantly superior to Avon in trials both at Temora and Condobolin and significantly superior also to all varieties, including Avon, in the Nitrogen-variety trials at Temora and Henty. The grain yield margin in favour of Avon x Osage as compared with Avon, appears to become wider in a season of moisture stress. This indicates the greater adaptability of the crossbred. Seed stocks of Avon x Osage are now being increased.

Coolabah, released in 1967, generally has a lower grain yield potential than Avon but this season Coolabah was in most instances superior to the popular Avon. This indicated a degree of drought resistance and confirmed the observation made in previous years that Coolabah appears particularly suited to drier areas.

Cooba, according to the latest Oat Variety Census, consolidated its position as the leading oat variety in N.S.W. It has increased from 22.6 per cent of the total oat acreage in 1965 to 29.4 per cent in 1966. Greatest gains were in the northern division of the State. There it advanced, from third position with 11.3 per cent in 1965, to the leading variety with 23.8 per cent of the acreage in 1966.

Performance of Glen Innes Crossbreds

The Glen Innes crossbreds P. 4314, P 4315 and P 4319 had the poorest grain yield performance of 49 varieties in the Temora 1/250th acre grain oat trial. They yielded about one-third less than the leading varieties. Because of their slow, early growth and relatively late maturity they were more exposed to the full impact of the drought. They will be further tested but results so far indicate their unsuitability for southern districts.

Grain Oat Variety Trials with Nitrogen

The varieties Fulmark, Avon, Bundy, Coolabah, and Avon x Osage were tested at Temora and Henty with nitrogen applications of 0, 20, 30 and 50 lb per acre. No significant differences were observed as between nitrogen rates, and nitrogen effect was erratic and not consistent for each variety. However, differences between varieties were significant. Avon x Osage outyielded all other varieties at each site.

WEED INVESTIGATIONS

Skeleton Weed (Chondrilla juncea)

Further experiments into factors affecting flowering indicated that bolting and flowering are separate processes. An inhibitory process, more active when dark periods were inserted in the daily photocycle, attained maximum expression at moderate (21°C) temperatures. It was inactivated by high (26°C) but not by low (13°C) temperatures.

The root system was found to be heterorhizic. It consists of robust, perennial long roots and short or "annual" roots. The long roots are of two kinds: a deep, rope-like taproot extending, often unbranched, to considerable depth (200 cm) and, generally only in very sandy soils, shorter and more or less horizontal laterals in the 15 to 30 cm soil horizon.

Post-emergence control of skeleton weed in the cereal crop with picloram/2,4-D, picloram/MCPA mixtures and picloram K salt, applied at 0.25 oz, 0.375 oz and 0.75 oz a.i. picloram, gave control of skeleton weed as good as but not better than the standard 12 oz of 2,4-D. Best time of application was at the 4 to 5 leaf stage.

Soursob (Oxalis pes-caprae)

Control of soursob in a mixed soursob/skeleton weed sward was attempted by cultivation at the bulb exhaustion stage, cultivation at bulb exhaustion followed by sowing a sudax summer-fodder crop, and by spraying at the bulb exhaustion stage with atrazine 2 lb a.i., amitrole-T 5 lb a.i., diuron 2 lb a.i., linuron 2 lb a.i., metobromuron 2 lb a.i.-(2-methyl-phenoxy) propionic acid (MPP) 4 lb a.i., and picloram 8 oz a.i., 12 months before sowing a cereal crop. Fenoprop 2 lb a.i./ac., was applied post-emergence at the 3 leaf stage to half of each treatment.

All treatments except MPP reduced soursob populations. Maximum reduction was obtained with picloram plus fenoprop treatment. Because of the response of skeleton weed as well as the soursob to picloram this treatment more than doubled wheat yield. Other treatments did not affect wheat yield significantly.

Direct Drilling of Cereals

In the direct drilling technique of crop production, unwanted vegetation is removed by chemicals prior to sowing the crop into the otherwise undisturbed soil. Sowing crops without ploughing or cultivating offers economic advantage to farmers in some circumstances. A study of the direct drilling technique was commenced in 1967.

Despite extremely adverse seasonal conditions the first results have been encouraging. Some treatments showed significant differences between direct drilling and commercial cultivations, provided at least 8 oz a.i./ac. of paraquat were applied before drilling, but there was no advantage in favour of either treatment.

PASTURE INVESTIGATIONS

Stocking Rates/Superphosphates Rates Trial

The stocking rate (2, 4, 6 dry sheep per acre) by superphosphate rate (0, 1, 2, 3 cwt per acre per year) trial has been described in previous annual reports. It entered the cropping phase in 1967. Because of the adverse season and resulting low grain yields, residual effect of phosphate applied during the pasture phase was not manifest. The cropping phase is to be continued.

Because of the results from this trial at the Institute, investigations of the sort are being extended into the region. Four sites are being selected on private properties in the wheat-sheep zone around Wagga Wagga. Two will be in the lower rainfall area (17 in–19 in) and two in the higher rainfall area (22 in–24 in). In each rainfall zone, one site will be on a "low phosphorus status" soil and the other on a "high phosphorus status" soil.

The sites will be stocked with breeding merino ewes at two rates. Superphosphate will be at three rates including a "nil" application. The trial will begin in time for autumn 1969 mating of the ewes.

Management: Time of Lambing Trial

In deciding management strategies prime lamb producers in the district have to weigh advantages of lambing in the autumn (prices received for lambs turned off may be higher, and there is no grass seed problem) against the advantages of lambing in the spring (a likely higher lambing percentage and the lambs born in a period of rising temperatures conducive to growth vigour). No definite answer can yet be given on the most profitable course of action.

Therefore a trial comprising two stocking rates (3 and 5 crossbred breeding ewes/acre), two lambing times (autumn and spring), and four management systems (involving autumn deferment and supplementary pastures of oats and lucerne) has been commenced. The oats and lucerne areas are to be used primarily to top off the lambs and comprise 50 per cent of the area. While lamb requirements are being met adequately, ewes may also graze these areas. The trial is based on a sub-clover and wimmera ryegrass pasture and is topdressed annually in the autumn with 1 cwt superphosphate/acre. Sheep were successfully mated to Dorset Horn rams in the autumn of 1968.

Weaner Feeding

During the drought of 1967–68 a drought feeding trial was conducted with lambs. This was to determine the most economical feed for weaned lambs.

Wheat is the cheapest source of fodder with a satisfactory level of protein. Therefore, the higher the wheat content the cheaper the fodder. But digestibility of wheat is low in lambs and some roughage is required, as was demonstrated.

Three diets were fed at a level of 3.6 feed units. The three were: (a) 100 per cent wheat grain; (b) 75 per cent wheat grain (2.7 feed units) and 25 per cent pasture hay (0.9 feed units); (c) 50 per cent wheat grain and 50 per cent pasture hay. These diets were fed to weaners divided into three body weight levels. The mean body weights were 33.4 lb, 27.7 lb, 22.2 lb.

No relationship between weaning weight and growth rate showed. However, there was significant growth rate difference as between diets which included pasture hay and the diet of 100 per cent wheat grain. Therefore it would appear that weaning can be done successfully at a mean body weight of 22 lb and the weaners hand fed, provided the diet includes some roughage—comprising less than 25 per cent of the fodder in terms of feed units.

Dry Land Lucerne

Lucerne in the Wagga district has been used mainly on creek and river flats. Very little is grown on higher country, because of reputation for poor persistence. This is considered to be mainly a management problem. Lucerne on creek flats is cut for hay but lucerne on the hills is continuously grazed. Thus the latter is selectively grazed. In consequence the root reserves are steadily depleted, the recovery becomes less vigorous, and less palatable associate species shade the lucerne shoots and gradually dominate the sward.

A trial is now being conducted to examine two management systems (3 paddocks and 9 paddocks) at two levels of stocking (4 and 6 sheep per acre) using breeding merino ewes and spring lambing. Production at the low stocking rate is being compared with production at the same stocking rate on a wholly annual pasture.

Animals had to be removed in December, 1967, due to drought but until then the management systems had shown a small difference in favour of a three paddocks system. A stocking rate effect was also apparent. This was in wool production, body weight, and growth rate of lambs. Numbers of lambs weaned showed no stocking rate effect but did appear to favour a three paddocks management system. Certainly there was no advantage in the very intensive subdivision on any score.

During the very dry late spring the lucerne stand was seriously thinned (35 per cent reduction in density, by counts) and at present it is doubtful that the trial can continue.

Winter Fodder

Winter fodder production of oats, barley and wimmera ryegrass using three levels of nitrogen (0, 20 and 40 lb per acre, as sulphate of ammonia) were compared in a 1967 trial.

Because of the drought, only one cut (on 4.9.67) was practicable but it indicated that continuance of this work would be worthwhile. Response to 20 lb of nitrogen was apparent, although of unknown economic value. Also, wimmera ryegrass outyielded the cereals at all levels of nitrogen but would be unfair comparison because the cereals were not sown till 2nd June. By that time the wimmera ryegrass was established.

PLANT PATHOLOGY

Bunt of Wheat

Further testing of fungicides for control of bunt (*Tilletia caries* and *T. foetida*) showed that several non-mercurials are available to take the place of HCB if the Victorian race of *T. foetida* resistant to this fungicide were to be found in N.S.W.

Field trials with Methoxyethyl mercury silicate showed conclusively that this is much inferior to other mercurials. In combination with the insecticides lindane and especially malathion it was ineffective. As a result of this work the active ingredient in the product concerned has been changed to phenylmercuric acetate.

Loose Smut of Wheat and Barley

Following preliminary investigations in the laboratory and glasshouse, the systemic fungicide vitavax (2,3-dihydro-5-carboxamilido-6-methyl-1,4-oxathiin) was evaluated in the field under practical conditions. Its control of loose smut was excellent even at half the recommended rate, but it was only moderately effective in an irrigated row-plot trial, using wheat artificially inoculated with loose smut. The reason for this discrepancy is being investigated.

Take-all

Work has started on devising a reproducible method to test wheat varieties and other gramineae for their relative susceptibility to *Ophiobolus graminis.*

PLANT PHYSIOLOGY

Water-use Efficiency in Wheat Production

The first main experiments for measurement of the water economy of wheat varieties have now been completed. The outcome is being prepared for publication. These experiments have been mainly concerned with the vegetative stage of the wheat plant, to lay the basis for an understanding of the grain production stage.

Equipment in the Plant Physiology Field Shelter is now being modified so that larger soil volumes may be handled. Then experimental work on the water economy of wheat including the reproductive stage will be undertaken.

CROP AGRONOMY

Weed Survey

The first of a series of weed surveys was undertaken in 1967–68. It showed that on average one-fifth of the total dry matter produced in wheat paddocks throughout the southern wheat belt up to flowering time was weeds. The ultimate effect of this weed competition was to reduce wheat yields by 13 per cent.

Black oats, Wimmera ryegrass, skeleton weed, capeweed and fumitory were clearly the most widespread weeds in the area.

Another survey was commenced in May, 1968, incorporating modifications suggested by experience in the first study.

Fallowing and Wheat Production

The adverse conditions of 1967 resulted in only two of the four fallow trial sites being harvested. Yields were low, due to the late sowing and lack of growing season rainfall, and there was no relationship with length or method of fallow preparation.

A further three sites in the 16 in to 24 in annual rainfall area were established in the spring of 1967 for the 1968 growing season. As in the studies reported in previous annual reports, there was no additional conservation in moisture by long fallowing (spring, 1967), compared with mechanical or chemical seed bed preparation in the autumn of 1968. Long fallowing, however, gave the expected increase in the concentration of available mineral nitrogen at sowing.

Wheat Nutrition

The drought resulted in poor development of field trials and in abandonment of some.

Nitrogen Fertilizers and Wheat

Initial investigation of the influence of forms of nitrogen fertilizer (urea, ammonium sulphate, ammonium nitrate), method of application (pre-drilling, broadcasting, drilling with seed), and rates, was adversely affected by the season.

Drilling the fertilizer in close proximity of the seed seemed to be an advantage but direct contact, particularly at high fertilizer rate, caused poor germination. In the 1967 conditions, urea and ammonium nitrate were superior to ammonium sulphate.

Nitrogen Soil Tests

Studies of the possibility of a suitable nitrogen soil test for the southern N.S.W. wheat belt are being continued in two main projects.

In one project a number of available soil nitrogen indices selected through preliminary glasshouse and field studies (see 1966–67 Annual Report) are being used, to obtain correlations with wheat yield from regional fertilizer trials involving various rates of nitrogen (as urea) and phosphate (as superphosphate). This programme will continue for several seasons.

The second is the "Critical Levels of Soil Nitrogen Project".

A survey was started in 1967, towards defining two soil nitrogen levels, below and above which wheat crops will or will not respond to nitrogenous fertilizers. Some 243 sets of crop and soil data were obtained. About 10 per cent of the sites showed at flowering clear responses to the two rates of ammonium nitrate broadcast at sowing time.

Some of the soil tests used to classify available soil nitrogen levels showed no promise at all. Others, singly and in combination, clearly defined low soil nitrogen sites; for example, the 30 sites in the lowest soil nitrogen class as defined by two particular tests yielded 9.2 bushels per acre on average (without added nitrogen) compared with a yield average of 18.2 bushels per acre (without nitrogen fertilizer) from the 30 sites in the highest soil nitrogen class as defined by the same two tests.

However, because of the dry conditions throughout the entire growing season the response to added nitrogen fertilizer was very slight. At the low soil nitrogen sites the average effect of broadcasting 30 lb of nitrogen as ammonium nitrate at sowing was to raise yields from 9.2 to only 10.2 bushels per acre.

For the 1968–69 season, arrangements were made to locate over 350 similar experiments throughout the region. But considerably less than this total will in fact be established, because of the wet conditions in May and June, 1968.

Comparative Evaluation of Types of Phosphate Fertilizer

Two field trials were established to study the performance of four different proprietary brands of phosphatic fertilizer; 22 per cent superphosphate, 44 per cent Hyfos, 12:52:0 and 18:18:0 were sown with the seed at rates equivalent to 0, 90, 135, 180 lb/acre of 22 per cent superphosphate. Two series were sown. In one the P_2O_5 rates were balanced and in the other the nitrogen rates were balanced by adding an appropriate quantity of sulphate of ammonia. All fertilizer was sown with the seed (Heron wheat).

Both trials reached maturity but yields were depressed by the dry conditions. The results were inconclusive.

The new trials now proceeding include more types (15:30:0 and 18:46:0) and balancing of the nitrogen level has been omitted.

Fertilizer Placement Trials

To study the effect of placement of fertilizer on development and grain yield 22 per cent superphosphate and 12:52:0 were sown with seed at three rates and three placements. This trial failed due to drought.

Urea and sulphate of ammonia were applied to wheat to study the effects of three methods of application of nitrogen to a wheat crop. This trial also failed due to drought.

Sowing of the 1967–68 seasons trials has begun, delayed by rain. The programme includes 15 field trials (5 x 5 factorial with 2 replicates) with superphosphate and urea. The trials have been designed to meet the needs of continuous calibration of soil P tests, research into the practicability of a soil nitrogen test, and agronomic investigations of fertilizers.

Soil Testing for Phosphate

A successful harvest was taken on 54 wheat fertilizer trials, for three years. In each trial superphosphate at 0, 50, 100, 200 and 400 lb per acre was drilled with the seed. Each rate was applied as such only, but also with 40 lb of nitrogen as sulphate of ammonia broadcast at the 4 to 5 leaf stage.

Profitability was assessed in terms of return on wheat valued at $1.20 per bushel, against cost of superphosphate at $1.40 per 100 lb or nitrogen at 10 cents per lb. There was profitable response to nitrogen in 10 of the 54 trials; the proportion increasing on land in its third or fourth year of cropping to wheat. Where superphosphate was applied alone the best return was at the 100 lb rate.

Results from three rainfall zones (16–18, 18–20 and 20–24 inches per annum) were also studied separately. This showed that the chances of profitable return from the first 50 lb were at least 8 in 10 in all zones but that only when 20–24 in of rain could be expected was there a better than even chance of profit from 200 lb of superphosphate.

The soil from each trial site was analysed in the laboratory by 11 methods to determine the "available" phosphate. This was an attempt to relate that figure in each case to the response of wheat to added superphosphate. Results from five of the eleven methods were sufficiently encouraging for the Department of Agriculture to decide to expand its soil testing activities.

In consequence there will be a regional soil testing service, operated from the Agricultural Research Institute, Wagga. This will be a Pilot Service, restricted to phosphorus analysis of wheat soils in southwestern N.S.W. Samples will be accepted only when the Distrtict Extension Officer is of the opinion there is a need for chemical analysis.

A successful Soil Testing School was held in February, 1968, attended by all agronomists in the N.S.W. Wheat Belt.

SOIL CHEMISTRY

Wheat Growth and Phosphorus Availability in Waterlogged Soil

Samples of a red brown earth soil after mixing with various rates of soluble phosphatic fertilizer were subjected to waterlogging for periods of up to 4 weeks, in pots. Wheat was subsequently grown, and sampled at the 4–5 leaf stage and at maturity.

The longer the length of the waterlogging pre-treatment, the lower was the yield of grain. The available phosphate was also progressively reduced with increased period of waterlogging.

Up to 75 per cent of the variation in yield could be accounted for by variations in available phosphate. It appeared that waterlogging had little direct effect on plant growth, but indirect influence through the soil phosphate.

Wheat Varietal Efficiencies on Residual Phosphate

Two sources of residual phosphate made in the laboratory were used as sources of phosphorus for six wheat varieties—Falcon, Heron, Sunset, Thatcher, Opal, and Mexico 120. The responses of the varieties were compared at 4 to 5 leaf stage and maturity. Interpretation of the results has been difficult because the varieties respond differently at different stages of growth. Falcon and Heron outyielded the other varieties at maturity.

Comparing New Forms of Phosphate Fertilizer

Four new types of phosphatic fertilizer, Rhenania phosphate, calcium metaphosphate, potassium metaphosphate, and amonium polyphosphate as sources of phosphorus for wheat and clover were compared with basic slag, rock phosphate, calcined rock phosphate, calcined rock phosphate + superphosphate and monocalcium phosphate.

For wheat and for clover the best yields were promoted by monocalcium phosphate, basic slag, Rhenania phosphate, and ammonium polyphosphate.

Superphosphate History and Available Phosphate

A phosphate index (the ratio of aluminium phosphates to iron phosphates) has been proposed as a result of investigations on 24 soils of varying superphosphate history. This index is highly correlated with available phosphate and the absorption maximum of each soil. It will also indicate those soils wherein the application of superphosphate produces an increase in the absorption maximum.

Reduction of Fixation, and Release of Phosphates

Work is in progress to ascertain the value of chelates, detergents, silicates, and organic acids in releasing fixed phosphate or in preventing fixation of added soluble phosphate.

Agricultural Research Directorate, Tamworth Station

WHEAT BREEDING

Building for the National Wheat Variety Collection

Construction of the National Wheat Variety Collection building has started. The building will comprise special seed storage rooms, laboratory and offices, and is a major step in development of the Station. It will provide a service for wheat breeders and geneticists throughout Australia, while preserving for future generations the germ plasm collected in improvement programme since the time of William Farrer.

The facilities will be able to accommodate seed stocks of up to 20,000 varieties under temperature and humidity conditions most favourable to long life. Stocks will be renewed as is necessary. The collection will be under constant review and study in the search for characters of use in breeding programmes.

Durum Wheat

Seven semi-dwarf lines were yield and quality tested last season. Two lines, 2408 and 2030, showed promise and will be in extensive yield trials at eleven sites in the northwest during the 1968–69 season. The 1967–68 yield trials did not prove 2402 and 2030 superior to Dural, which experienced no lodging and yielded very well compared to the bread wheats. But 2408 and 2030 are semi-dwarf lines and would have a distinct advantage in seasons when Dural would lodge.

Of the 3,000 varieties of the U.S.D.A. world durum collection, 2,000 were grown in the field last season. They were under intensive observation from emergence to harvest and were screened for characters of use in breeding. Variation in maturity in durums is very limited, but among the varieties screened in the world collection were some that are considerably earlier than Dural. There were used extensively in crossing.

Dural is thought by many farmers to be a low yielder, but its yield potential is much greater than is commonly believed. In seasons when no lodging occurs its yield compares with present bread wheat varieties. Time of sowing is important for Dural yield. A trial to examine the effect of seeding date on yield of durums generally is being conducted.

Hybrid Wheat

A number of sterile lines have been developed, and crossing to transfer sterility to as wide a range of varieties as possible is continuing. Fifty steriles are being developed. These include lines of Mendos, Gabo, Gamut, Festiguay, Glenwari, Eureka, Falcon, Festival, Ford and Marquis. The most advanced lines are in the fifth back cross generation.

Fertility-restoring lines are not as advanced as the steriles. There will be emphasis on these in the ensuing 2 or 3 years.

Although hybrid vigour has been examined by a number of workers there is as yet no accurate data as to its extent and expression between varieties adapted to Australian conditions. In order to examine the expected increase in yield due to heterosis, a large number of varieties were hand crossed. Some are genetically similar and some are genetically diverse. The seed obtained from the crosses have been sown for the 1968–69 season.

Winter Wheats

Lack of late summer and early autumn rain delayed sowings of winter wheats until April, so grazing data were restricted to two cuts only. The programme has two major sections:

(1) Full Winter Wheats: These are of similar developmental pattern to the Australian winter wheats Winglen and Windebri. Wheats of this class are regarded primarily as grazing types. Lines with good baking quality and satisfactory level of stem rust resistance are available.

(2) Alternate Winter Wheats: The components of this class have been selected for a lesser degree of winter ness than in the other class, but with no less winterness than in the variety Festiguay. In this class the emphasis is on grain yield without grazing.

The semi-dwarf winter wheats again demonstrated disappointing vegetative production and have been discarded.

Spring Wheats

Emphasis in the yield testing programme was on sorting for yield and quality the numerous M-8127 lines of the pedigree Warigo x Kpng x Mexico 1 x Uruguay, reselected by Dr H. Luig of the University of Sydney for rust resistance. From this material two lines 8127–266 and 8127–269 have been selected for further testing and preliminary increase.

Sufficient seed of local dwarf and semi-dwarf lines for preliminary yield testing at district centres was available for the first time. Extremely adverse seasonal conditions limited the data derived. Straw height was so reduced that in the case of full dwarfs the available harvesting equipment could not gather the grain, and for the shorter semi-dwarfs the yield data did not do justice to the yield potential. New equipment made available by the Wheat Research Council will in future rectify this situation.

The semi-dwarf spring wheat lines were heavily selected for milling and baking quality, and a few lines have been promoted to further field trials. These have shown yield and quality superiority to Mendos on at least one occasion.

Miscellaneous Notes

Material Exchanged for Yield Testings.—Material was exchanged with the North West Wheat Research Institute, Narrabri, and some was made available also to the Central Western Wheat Improvement Programme.

Co-operative Small Scale Plot Work.—This was undertaken on the Station in co-operation with the University of New South Wales and the University of New England. Dr Luig, University of Sydney, provided valuable assistance to the programme throughout the season in rust testing.

Plot Harvester Designed and Built.—The Wheat Research Council made funds available for this purpose. The new machine was not available in time for the harvest. But in field trials held in January, 1968, after 5 in rain, it returned excellent grain yields from plots of semi-dwarf wheats. The machine appeared to be a major improvement in regard to ease, speed, and cleaning ability after harvesting.

PLANT NUTRITION RESEARCH

A. *Nutrition of Pasture Species*

Lucerne: Phosphorus and Sulphur.—The final experiments in a series of glasshouse experiments on northern wheat belt soils are in progress. There have been five experiments, on 51 soils, in the past 3 years; two of them during the past 12 months. Data are now sufficient to locate the major areas of sulphur deficiency in the northern wheat belt and to examine plant analysis as a diagnostic technique for lucerne.

Of the 20 soils examined in the last year, 10 proved to be deficient in phsophorus and at least 15 have some degree of sulphur deficiency for lucerne. Chemical analysis of the plant tissue is still proceeding but progressive results indicate that the marginal zones for both phosphorus and sulphur in the lucerne tops is about 0.13 to 0.18 per cent dry matter.

A series of field experiments has been initiated, to calibrate phosphorus and sulphur concentrations in the lucerne tops with phosphorus and sulphur fertilizer requirements for optimum lucerne yield. The first four experiments are at the Research Station. Since their establishment, dry conditions have prevented sufficient growth for yield determination.

White Clover: Phosphorus and Sulphur—Initial and Long Term Needs on Coarse Granite Soils.—The last three in a series of nine field experiments on three sites were recently established. Each of these experiments will continue for at least 5 years, but all data on initial requirements of each nutrient should be available in mid-1969. A 2-month summer drought in 1967–68 killed all white clover sown in 1966 and two of the trials sown in 1967, but all of these trials have now been re-established.

Maximum yields of both dry matter and protein in the first year were obtained with about 100 lb P_2O_5 and 25 lb S per acre; yields 3 to 9 times greater than those in the absence of applied phosphorus. Relative increases in protein yield were considerably greater than those in dry matter yields. In the second year harvests there was marked residual response to phosphorus applied in the first year.

B. *Nutrition of Crop Species*

Wheat: (i) Sulphur Nutrition in Relation to Agronomic Factors.—Two experiments were carried out on sites known to be sulphur deficient for lucerne. The purpose was to determine the effects of length of fallow, length of growing season, and nitrogen nutrition, on the sulphur status of wheat. Drought during the normal wheat fallow period prevented inclusion of the second of these factors.

Yield responses to nitrogen were highly significant in both experiments. Neither experiment revealed response to applied sulphur. However, chemical analysis showed that there was little uptake of applied sulphur by the wheat. The very dry conditions during the early growing period would seem to explain the wheat's failure to absorb the sulphur.

Wheat: (ii) Nitrogen Nutrition After Lucerne Leys.—The two major long term experiments on the Research Station were continued. Dry conditions lowered the wheat and the lucerne yields, so loss of soil nitrogen via the wheat crop and gain of soil nitrogen via the lucerne crop were each reduced.

Soil moisture determinations to 200 cm depth showed very significant reductions in soil moisture under lucerne, particularly on the black earth. Soil moisture on the red brown earth was reduced from 28 per cent under fallow to 21 per cent under lucerne, at 30 cm depth, and from 26 per cent to 20 per cent at 200 cm depth. Soil moistures on the black earth were reduced from 35 per cent under fallow to 22 per cent under lucerne, at 30 cm depth, and from 29 per cent to 21 per cent at 200 cm depth.

In experiments harvested on two sites in the district the experimental wheat crops immediately followed lucerne leys, and in neither case was there a response to applied nitrogen. This indicated adequate nitrogen status of the soils. The two experiments have been re-established at the same sites, and two more have been sown at other sites.

Maize: Sulphur and Nitrogen Nutrition.—One exploratory trial was carried out to investigate suspected sulphur deficiency in maize on the Liverpool Plains. There was only slight response to nitrogen, and no response to sulphur. Further glasshouse work showed there was little if any deficiency of sulphur in this soil.

PLANT PATHOLOGY RESEARCH

The research into plant diseases this year concentrated mainly on three problems: *Verticillium* wilt in cotton; maize mosaic virus in summer crops and root rot of safflower. Disease problems associated with cereals and other field crops such as lucerne and sacchaline were also investigated.

Verticillium Wilt in Cotton

Related to Fields' History.—A 1967 survey in cotton crops showed high incidence of the disease in parts of the Namoi Valley and a relationship with history of the fields. Diseased plants were rare in fields that had no history of farming, but incidence was higher in fields that had been cultivated more regularly in the past. It seemed likely that the cultivation for growing grain crops had been accompanied by introduction of a larger and more varied complement of broad leafed weeds whereon *Verticillium* may persist and increase.

It was predictable that *Verticillium* wilt would continue to increase in fields continually cropped with cotton unless there were adequate attention to control measures.

Weed Hosts for Verticillium.—A survey of most of the more common weeds showed only five species to be systematically infected by *Verticillium*. These are Noogoora burr, Gomphrena weed, Bladder Kitmia, Turnip weed and Cape Gooseberry. However, the fungus is able to infect the roots of every species of weed in the Valley, and able to persist there without the host showing evidence of infection.

Other Crop Hosts.—Further studies with cultivated crops have shown that all plants, including cereals, are infected in a field soil but the fungus develops more in the roots of some plants than in others. Accordingly, plants have been rated for their ability to carry *Verticillium*. It is possible to formulate specific rotations, to reduce the level of the fungus in soil.

Verticillium Not Indigenous to Namoi Valley.—Observations on incidence and distribution of *Verticillium* wilt in 1967 and 1968 indicate that the fungus is not indigenous to the Namoi Valley, but been introduced probably within seed of Noogoora burr. Dissemination of the fungus has been facilitated by infected burrs moving in flood waters, and doubtless also by animal dispersal.

Incidence in 1968 *Cotton Crops.*—Crops in fields which showed high incidence of *Verticillium* wilt in 1967 were heavily infected again in 1968. Crops in fields with little or no wilt in 1967 were again in 1968 almost free from the disease.

There was, however, a trend to lower overall incidence of *Verticillium* wilt in the 1968 crops, especially where a crop had been stressed for water during the growing season. There was marked increase in wilt incidence in three fields where the crops were well grown and not stressed at any stage of growth. In these three fields the wilt increases were from 3.6 per cent, 3.6 per cent and 5.6 per cent in 1967, to 26.4 per cent, 40.4 and 66.8 per cent in 1968.

Maize Mosaic Virus in Corn

The disease is widespread in the Tamworth and Grafton districts and been identified in maize from Narrabri, Mudgee and Windsor. The virus can be found in a number of summer growing species, including grain and forage sorghums and Johnson grass.

A number of maize inbreds are resistant to the virus. Work is now being directed to determining the nature of the resistance. It appears to be simply inherited.

Safflower Root Rot

Root rot is a major factor operating against securing high yields from irrigated safflower. A number of pythiaceous fungi are involved as primary parasites. The answer will probably be found in selection of resistant varieties.

PLANT PHYSIOLOGY RESEARCH

Environment and Yield and Development of Wheat

Four wheats, Gamut, Festiguay, Mexico 120, and 8127 were sown at five sowing times: May 31, June 29, July 19, August 14 and August 30.

Grain yield of each variety was higher for the second sowing than for the first, due apparently to a period of moisture stress after anthesis of the first sowing. Yield fell away for the third, fourth and fifth sowings; less so for Mexico 120 than for the others. The highest yields for the first two sowings were from 8127 and from Mexico 120 for the last two sowings. Festiguay consistently produced lowest yield.

The final sowing was 91 days after the first, and this reduced by about 60 days the interval from sowing to maturing of all four varieties. The greatest relative reduction was in the period from brairding to flagleaf formation. This period was reduced from about 92 days in the first sowing to 44 days in the last, for Mexico 120, Gamut, and 8127, and from 104 days to 59 days for Festiguay.

There was positive correlation between yield and days elapsed from anthesis to the soft dough stage. Relationship between yield and photosynthetic area duration has yet to be determined.

For 8127 and Festiguay there was a linear relationship between yield and total dry weight at maturity. This was less apparent for Gamut and did not hold for Mexico 120.

Soil moistures were recorded through the season with a neutron moisture meter. Wide differences were recorded, resulting from different times of sowing.

Wheat Frost Resistance

Variety and Species Comparisons.—Completely controlled environment and nutrition for the growth of plants prior to frost testing has made possible the evaluation of a much wider spectrum of material than formerly. Winter wheats, a number of grass species and a group of spring wheats collected in Afghanistan have been tested. From each of these groups, strains markedly superior to the previous standards for resistance have been selected.

Notable among the selections are: *Aegilops peregrina, Triticum aethiopicum* and the bread wheats Cheyenne (winter wheat, from U.S.A.) and H996 and M972 (from Afghanistan).

Genetic Experiments.—Cheyenne and H996 have been crossed with susceptible varieties to study the inheritance of frost resistance. Behaviour of F1 plants indicates that resistance is dominant to susceptibility, although the opposite was indicated in earleir experiments involving the Mexican strain No. 101.

This leads to the hope that different factors for resistance may be available from different varieties. Therefore the obvious next step, an attempt to combine them, has been initiated.

Study of Ice Formation in Ear Tissue.—A special freezing chamber was constructed, to study ice formation in ear tissue. The unit gives extremely close control of temperature under conditions of high relative humidity. At the same time it allows visual observation of plant material. It has been used in conjunction with measurements of electrophoretic characteristics of cells to study formation and spread of ice in the ears of wheat and related species.

Chemical Studies.—The effects of various sulphur, nitrogen, phosphorus, and potassium levels of nutrition on frost resistance continued to be studied. The plants are grown in sand, with nutrient solution additions.

Sulphur deficiency where severe enough to cause reduced growth led to significantly less frost damage to both ears and stems. Deficiences of nitrogen and phosphorus although also effective in reducing growth did not decrease damage. If anything, they reduced resistance to stem injury.

An experiment has been initiated to obtain information on the translocation of phosphorus, nitrogen and sulphur through the stems of plants freeze-damaged by applying a freezing clamp at known tempertaures to a lower internode of each stem. So far the results show that stem freezing, though it markedly decreases the diameters of some of the stems in the frozen region, has no effect on grain dry weights, grain numbers, grain phosphorus and grain nitrogen concentrations. Stem freezing, however, significantly decreased the root dry weights. This appears to indicate decreased downward translocation of photo-synthate through the freeze damage stems and suggests impairment of phloem function.

PASTURE RESEARCH

Two Dissimilar Environments

Pasture research for the area is concerned primarily with two very dissimilar environments: the low altitude (about 1,200 ft) arable Tamworth area where wheat growing is the major enterprise; and the granitic grazing country of the southern New England tablelands. The studies reported here, except those specific to behaviour of root nodule bacteria, were joint projects with Division of Plant Industry and Division of Animal Industry. Three research fields have been emphasized:

(i) evaluation of pasture and forage species;

(ii) effectiveness and ecology of root nodule bacteria and their contribution to nitrogen fixation, in the wheat growing area *and* the adjacent granite areas (studies supported by funds from the Australian Meat Research Committee);

(iii) lucerne management and physiology.

Pasture Species Evaluation on the Arable Soils of Tamworth District

Three Phase Programme.—For this environment where both summer and winter-spring growing crops are basic agricultural activities there is marked lack of established pasture species except lucerne (Hunter River cultivar) and annual medics. The programme of pasture species evaluation has three phases.

Phase I comprises screening for survival in single plant rows, and general observations of response to the environment. To date several summer growing legumes have been examined.

Phase II comprises agronomic testing as well as selection under heavy grazing at regular intervals. The crucial test of a potentially useful plant is to add it to the ecosystem and test it for a significant improvement in animal production. The new plant may fail to establish satisfactorily or fail to persist in real world or farm-scale situations; on the other hand it may substantially increase the total plant yield. Inherent in this testing is acceptance of the risk of loss of some potentially useful species or cultivar in order to achieve within 2 to 3 years a rapid and reliable selection for Phase III—the evaluation of pasture and forage species under grazing.

Plots of commercially available temperate grasses, sown in 1966, have been heavily grazed at regular monthly intervals to examine persistence. Yield data are also being collected. Following the severe moisture stress of the 1967 spring, and the 1968 summer-autumn, *Phalaris tuberosa* and Demeter Fescue are the only perennial grasses exhibiting reasonable persistence. Among the annuals Wimmera and Meridan ryegrasses have regenerated well. The other ryegrasses have disappeared.

A range of *Phalaris* cultivars, sown in 1967, has also been subjected to regular heavy grazings. The cultivar "Special Select" and the hybrid (*P. tuberosa* x *P. arundinacea*) have shown the greatest persistence. Other cultivars are rapidly disappearing as a result of the severe moisture conditions that occur.

A lucerne cultivar x *Rhizobium* strain experiment in collaboration with Dr A. H. Gibson, CSIRO, Canberra, was sown in May, 1964, and initially terminated in autumn, 1967. Following indications of superior yield of the African cultivar of lucerne during the winter months, this was more closely investigated during the 1967 winter. The yields of African and Hunter River lucerne during the winter were found to be similar despite distinct difference in growth habit. All varieties persisted satisfactorily, including Canberra Creeping Rooted (Cancreep) and African. Yield determinations ended in the 1967 spring.

Four sheep per acre are now being grazed continuously on these cultivars to examine persistence under set stocking. It has been claimed that Cancreep but not the other cultivars will persist under this treatment, but so far there is very little indication of decline in density of any cultivar.

A range of commercially available summer growing grasses were sown in 1967 and 1968. There have been difficulties in establishing. Only a few species have become established. These trials will be sown again in the 1968 spring, using several establishment methods.

Concerning Phase III, the evaluation of pasture and forage speciés under grazing, the existing situation in this environment is that lucerne is essentially the only perennial pasture plant sown. It constitutes the basis of the feed year. Other species or pasture types contributing to Tamworth district's feed year are natural pasture with naturalized annual medics, summer forages and winter forages (oats). Little is known of the potential of the pasture types for animal production.

Analysis of Peel Shire records for 1963–64 indicated a carrying capacity of almost two sheep per acre. Agronomic data from lucerne alone have suggested a carrying capacity of six sheep per are. Even this figure might be increased by lucerne combined with the other feed sources available. The potential of these species can seldom be evaluated satisfactorily from agronomic data alone. Animal data are needed.

The programme is initially to examine each type of food source individually, to obtain some measure of its potential, and finally to incorporate the various components into a feed year for this environment.

Grazing Evaluation of Lucerne.—Evaluation of lucerne under a range of stocking rates (3.3 to 8.7 dry ewes/acre) started in November, 1966. From agronomic data it was estimated that lucerne should support 6.0 dry ewes/acre, and from data collected since the start of the experiment it seems that this figure is about right. At stocking rates above 6.0 sheep per acre there has been severe deterioration in stand density.

Deterioration in stand density has been due to a number of factors, the major one the sheeps' digging and subsequent eating of the crowns. Once the crowns are removed very few plants survive. Those that survive do so by means of adventitious shoots from the tap root.

The other factor in loss of density has been severe infestation, on the red soil, by white fringed weevil. The weevil has damaged about 90 per cent of the plants. Weevil damage seemed to predispose the plants to damage by the severe moisture stress which occurred particularly in late summer. At the higher stocking rates losses of up to 50 per cent occurred on the red soils during this period.

In the conditions of the past 2 years soil moisture has been virtually exhausted between falls of rain. Lucerne production has been totally dependent on incident rainfall rather than stored subsoil moisture, so production dropped sharply during periods of low incident rainfall. In the past 12 months lucerne growth rate has been governed almost solely by moisture. Temperatures have had little effect.

Substantial hand feeding of lucerne has been required for the two highest stocking rates, whereas at and below 6.0 sheep/acre essentially no feed has been introduced into the system.

Grazing Evaluation of Summer Forages.—Forage sorghums have potential for high dry matter production, but little is known of their value for animal production. Two types of sorghums are being examined in the research programme: the high yielding hybrid forage sorghum Sudax, an annual, and the perennial *Sorghum almum*.

Before the release of Sudax and other high producing hybrids *S. almum* found favour with northwestern graziers. It is being examined in this work because of its low cost compared with the annual Sudax. *S. almum* has been reported to remain productive for 5–10 years.

Under dryland conditions in this environment, forage sorghums are regarded as a backdrop to lucerne and natural pasture during the summer.

Towards evaluation of hybrid forage sorghum, Sudax was sown in late October, 1967, on one inch of rain. The next effective rainfall was in the early part of January, 1968, when almost 10 inches were recorded. After the January rain the next effective rainfall was received in May, 1968. Moisture was a severe limiting factor during most of the experiment. Growth of Sudax virtually ceased in early May, with the advent of severe frosts.

The trial included three stocking rates (8, 16, and 24 sheep per acre), with set stocking and a four paddock rotation as the two management treatments. Two replications were used. From a preliminary analysis of results the rotational grazing management appears to have a slight advantage over the set-stocked treatment. After examining sheep body weights it would seem that the superiority is due simply to a rationing of the available feed in the rotational system.

The highest stocking rate (24 sheep/acre) was found to be too high. Stock had to be removed from the system early in the trial. At 16 sheep/acre feed supply was fairly well equated with animal needs for the 5-month period of the experiment.

During the period of rapid growth lasting for about 4 weeks after the heavy rain in January the sheep were unable to ingest sufficient dry matter to maintain body weight—due to the exceedingly high moisture content of the herbage.

Towards evaluation of *Sorghum almum*, a lower producer than most of the hybrid forage sorghums, stocking rates lower than in the other trial were applied (6, 12, 18 dry sheep/acre). Only a rotational management (2-paddock system) was used.

At 18 sheep/acre, the sheep remained on the trial for only 2 months. The 12 sheep/acre treatment allowed grazing for about 3½ months. Thus in the season recently experienced it seemed that the carrying capacity was considerably less than 12 and fairly close to 6 sheep/acre.

Grazing Trial on Winter Forages (Oats).—This was started in 1968 autumn-winter.

Laboratory and Glasshouse Studies on Rhizobia

Rhizobium Numbers and Effectiveness.—The work of estimating *Rhizobium* numbers from experimental sowings and evaluating naturalized rhizobia for effectiveness of fixation, especially with lucerne, has been extended. It is now a wide scale evaluation of naturalized medic rhizobia collected from the northwestern N.S.W. wheat belt. Samples are now being obtained from black earths and red brown soils, from cultivated and uncultivated ground.

A combined field and laboratory study is in progress to examine further the quantitative relationship of *Rhizobium* numbers to nodule formation.

Pure Legume Stands' Nitrogen Fixation.—Short-term studies of legume responses to inoculation and nitrogen treatment were done with cowpeas at two sites and are being continued annually with cowpeas and lucerne. As in previous trials it was evident again this year that while nodulation responses may be obtained with inoculation, under some conditions the preceding fallow can provide sufficient nitrogen to prevent significant nitrogen input from the legumes.

Pasture Studies on Granite Soils of New England

The coarse granite soils of the southern New England have not responded satisfactorily to attempts at pasture improvement, although there appear to be climatically suitable species available. Study has been concentrated on the legumes and some of the factors affecting nitrogen fixation.

Effect of Cultural, Nutrient, and Inoculation Practice on Clover Growth and Rhizobium Survival.—Lack of cultivation and of elements other than phosphorus and sulphur have affected persistence of the legumes. But rhizobia has survived well under most conditions, suggesting that absence of root nodule bacteria is not necessarily a causal factor in loss of legumes from the pastures.

The severe spring drought of 1967 caused a severe decline in the white clover population. Samples of the soils under each treatment are being examined in the glasshouse to determine quantitatively the degree of nitrogen input from the legumes.

Effect of Rhizobium Strain on Yields of Lucerne Varieties.—This field trial, in collaboration with Dr A. H. Gibson, CSIRO, Canberra, was sown in May, 1968, and ended in the spring of 1967. Evidence of an apparent reduction in effectiveness of a *Rhizobium* strain is the subject of a paper now in preparation.

Nitrogen-fixing Ability of Temperate Legumes in Association with Grass.—Plots established at Bendemeer in 1966 with 10 legumes have been sampled at frequent intervals to determine total nitrogen fixation by legumes and the time of nitrogen release, in a mixed pasture situation where soil nitrogen levels are low. The lucerne is becoming essentially a pure sward by exclusion of the grasses. It has been by far the most productive and persistent of the legumes examined.

Evaluation of Perennial Legumes.—The range of lucerne cultivars sown in 1967 failed to establish. Three sites were sown again this year.

Micro-element Needs of Lucerne in Granite Soils.—A trial using lucerne as the test plant to determine the minor element deficiencies of granite soils in the Bendemeer region was started in June, 1968.

ROYAL BOTANIC GARDENS AND NATIONAL HERBARIUM

National Herbarium

NEW STATUS

The National Herbarium in March, 1968, ceased to be the Botany Branch of the Division of Science Services. Its administration combined with that of the Royal Botanic Gardens is now as an autonomous unit under the control of the Director and Chief Botanist.

Funds are awaited for working plans and construction of a new Herbarium building. Sketch plans and estimates based thereon were prepared during 1966–7. The new building is increasingly an urgent need.

SOME STAFF NOTES

The Senior Botanist, Dr Joyce W. Vickery, M.B.E., retired in December, 1967. Mr L. A. S. Johnson was promoted to this position which was later redesignated as Deputy Chief Botanist. Mr E. F. Constable, the Botanical Collector who had served for 22 years in this position retired in June, 1968.

Royal Botanic Gardens Assistant Superintendent Mr J. Thomas, N.D.H., resigned in December, 1967, to accept an appointment in Townsville, North Queensland. Mr W. Lester, formerly Head Curator, University of New South Wales, was appointed to the vacancy in January, 1968.

Landscape Designer Mrs E. Molenkamp transferred to a position with the National Parks and Wildlife Service and Mr I. Olsen was appointed to the vacancy on 13th May, 1968.

In addition there were 45 resignations from and 36 appointments to the operational gardening staff. This was the heaviest known turnover of staff at this institution.

BOTANICAL RESEARCH

Publications

"Contributions from the New South Wales National Herbarium".—Vol. 4, No. 1 of this series was published in May, 1968. It contained research papers on the genera *Typha*, *Eleocharis*, and *Acacia*.

The "Flora of New South Wales" Series.—No. 102 (Geraniaceae, by R. Carolin, University of Sydney) and No. 136 Supplement (Lord Howe Island species of Flacourtiaceae, by H. Sleumer, Rijksherbarium, Leiden) were published. Professor Carolin and Dr Sleumer were gratefully thanked for their contributions to "The Flora". Staff members reviewed and provided additional material towards these numbers.

The treatments of Centrolepidaceae and Loranthaceae (the latter contributed by Dr B. Barlow, Flinders University, South Australia) are complete apart from final editing. Preparation of sections on the important genera *Eleocharis* and *Cyperus* (Cyperaceae) and of the Lemnaceae is well advanced and treatments of some further genera of the Papilionaceae are being completed.

Other Publications.—A paper on "The perianth and the taxonomic affinities of *Eucalyptus cloëziana*" was published in the *Australian Journal of Botany* and a description and discussion of a new species of *Casuarina* was published in an appendix to "The Students' Flora of Tasmania" by W. M. Curtis.

Projects Completed or Proceeding

Investigations in *Eucalyptus* continued, including taxonomic problems of various species groups and also the development of a new system of classification of the genus, and clarified many points. Manuscript was prepared towards the new classification. Professor L. D. Pryor of the Australian National University, Canberra, is collaborating in this.

A phytochemical survey of *Acacia* species progressed. Chemical aspects are in the hands of Professor D. L. Roux, University of the Orange Free State, Bloemfontein, South Africa. The botanical section of a joint paper with Dr Roux has been completed and sent to the co-author.

Other studies in various groups of *Acacia* continued, including completion of further sections of the monograph of the *Acacia decurrens* group.

The major cytotaxonomic study of Restionaceae continued, with recognition of a number of new species and a much improved understanding of morphological features significant for an improved classification of the genera.

Cytotaxonomic revision of Australian species of the *Veronica* group advanced. The manuscript of the taxonomic part of a paper on the species of *Parahebe* has been sent to the co-author, Professor F. Ehrendorfer, of Graz, Austria, for completion.

Studies in the Proteaceae progressed. A revision of *Conospermum* in eastern Australia is complete and ready for final preparation of the manuscript for publication.

Further progress has been made in the revision of Australian species of *Galium* in collaboration with Professor Ehrendorfer, Austria, and the results are being prepared for publication.

Identity of plants collected in Australia by Sir Joseph Banks and Daniel Solander is the subject of a paper almost ready for publication, as the bicentenary of Cook's voyage in the *Endeavour* approaches.

A paper on miscellaneous species, largely rainforest plants, is in preparation. This will include decriptions of several new species.

Several genera of the Papilionaceae, especially *Bossiaea*, have been investigated for the continuation of the "Flora of New South Wales" treatment of the family.

Revisionary studies of Casuarinaceae and *Juncus* continued.

Euphorbia eremophila and allied species, some of which are concerned in stock poisoning, have been subject of preliminary study which will need to be continued in the field.

An appendix is being prepared to accompany a projected reprinting of *Orchids of New South Wales* by H. M. R. Rupp. It will include nomenclatural changes and records of species recorded for New South Wales since the original publication.

Corrections and new information have been provided for the fourth edition (in press) of the Departmental publication *Trees of New South Wales* by R. H. Anderson.

Tetratheca revision has been commenced by Mrs J. Thompson, a former member of the staff; the results to be incorporated in the *Flora of New South Wales.*

Chromosome study of species of the rainforest genus *Flindersia* has been initiated in response to a request from the Rain-forest Ecology Section of the CSIRO.

Revision of the Australian species of the grass genus *Poa* by Dr Joyce Vickery, former Senior Botanist, has been resumed and is well advanced.

The collections of *Dodonaea* have been organized as a first step towards a revision of that genus.

Xanthorrhoea has been the subject of further field and herbarium study. Some ecological and taxonomic relationships in this difficult genus have been clarified.

Extensive study of the Blue-green Alga *Anacystis cyanea* continued. This species has been involved in cases of poisoning of stock watered from dams in which seasonal growths ("water-blooms") of this alga occur.

Collaboration has begun in an ecological investigation of intertidal algae and marine animals in the Cape Banks area, initiated by zoologists from the University of Sydney.

Field Investigations

An extensive field study of many species of *Eucalyptus* was carried out in the Northern Territory, the Kimberleys and other parts of Western Australia, as part of a joint project with Professor L. D. Pryor of the Australian National University. Use of a light aircraft and a helicopter proved of great value in reaching remote localities.

The Widden Valley, Tuggerah Lakes, Picton Lakes, Wingecarribee, Shoalhaven Gorge, Upper Tuross River and Araluen districts were visited by botanists investigating particular species and for general observations in poorly collected areas.

A large area in the north and northwest of the State was visited twice in different seasons and by several staff members investigating a number of plant groups. These visits revealed several species previously unknown or little-known in New South Wales and proved especially valuable in work on grasses and on the genus *Xanthorrhoea.*

Extensive collections and observations were made in Queensland, the Northern Territory and South Australia by a botanist whilst on leave.

Field investigations in New Zealand are reported elsewhere.

Interstate Visits

Botanists visited the Herbaria in Melbourne, Adelaide and Brisbane to pursue their research projects and to hold discussions with staff members of those institutions. These visits also provided valuable opportunities for field investigations of plant groups under current study.

PLANTS NEWLY RECORDED FOR NEW SOUTH WALES

Acacia coriacea var. *angustior,* east of Narran Lake. Neither this variety or any other form of the species had been collected in this State. *A. coriacea* also occurs in Queensland, the Northern Territory and Western Australia.

Acianthus amplexicaulis, near Byron Bay. It is a small ground orchid, otherwise known only from Queensland.

Aizoön zygophylloides, near Tibooburra. Occurrence of this rather succulent annual in New South Wales had not been authenticated, though it had been "recorded" on the basis of its occurrence in South Australia near the New South Wales border.

Arabidopsis thaliana ("Thale Cress"), Dumaresq River and near Armidale. Not considered to be native in this State. This annual minor weed, of European origin, had been found as an escape from genetic experiments near Canberra. But the New England occurrences may represent a separate introduction.

Capparis loranthifolia, Angeldool district. Known from Queensland.

Coprosma nitida, Barrington Tops. The collections are not new but have been re-identified as this species. Known from Victoria and Tasmania.

Corynotheca lateriflora, Angeldool district. Known from the northern half of Australia.

Cyperus conicus, Pilliga Scrub. Common in the northern half of Australia.

Cyperus sculptus, two miles south of Woodenbong. Known from the coast districts of central and southern Queensland.

Eucalyptus dichromophloia, near Angledool. A widespread "Bloodwood" in the northern half of Australia, but not previously known from New South Wales.

Euphorbia stevenii, various northwestern localities. This species, which is suspected of poisoning stock, was previously confused here with *E. eremophila.* It occurs also in Queensland.

Gentiana sp., Wingecarribee Swamp, near Moss Vale. This is an undescribed species, of a group not previously known to occur in Australia.

Leucopogon recurvisepalus, Stockyard Creek, Copmanhurst. Known from southern Queensland.

Myoporum parvifolium, between Wentworth and Dareton. The first definite record for New South Wales. The species is known from north-western Victoria and South Australia.

Persoonia juniperina, Nadgee, far south coast. Common in Victoria, Tasmania and South Australia.

Ptychosema anomalum, east of Narran Lake. A small legume hitherto known from the southern part of the Northern Territory.

Rottboellia exaltata, "Kokoma Grass", Ten Mile Hollow, west of Mangrove Mountain. Not considered to be native in this State. Apparently introduced with tropical legumes. It occurs in the far north of Australia.

Sida cryphiopetala, Mulwarrina Creek, 35 miles south of Bourke. Known from South Australia, the Northern Territory and Western Australia.

Urena lobata ("Urena" or "Pink Burr"), Uki and Orara, in tropical legume trials. Not considered to be native in this State. Native of north Queensland and the Northern Territory, often a weed of roadsides and waste land or of newly established pastures.

RARE SPECIES AND EXTENSIONS OF RANGE

Acacia echinula, Stockyard Creek, Copmanhurst. Hitherto not known north of Dora Creek, south of Newcastle.

Acacia elata ("Mountain Cedar Wattle"), Mt Boss State Forest, Hastings River district. Known from more southerly parts of the coast and coast ranges.

Actinotus paddisonii, east of Narran Lake. Last collected in 1916.

Banksia canei, Tuross Falls. A species recently described from Victoria and known from only two localities in southern New South Wales.

Bonamia linearis, near Narran Lake. The only previous collection in New South Wales was from about 250 miles farther west.

Bothriochloa ewartiana ("Desert Blue Grass"), Terry-Hie-Hie, southeast of Moree. An easterly extension from Walgett and more western localities.

Brachiaria gilesii, Cobar. Previously known from more northern localities.

Cassia sturtii, between Enngonia and Weilmoringle. An easterly extension of the known range.

Casuarina paludosa, southeast of Nabiac. Hitherto not known north of Broken Bay.

Caustis pentandra, Corindi and Nabiac. A robust sedge which was known only from Broken Bay and the Blue Mountains southwards.

Coleocarya gracilis, southeast of Nabiac. Known previously only from the Macleay River district northwards.

Corybas dilatatus near Humula. This small ground orchid has been reported to occur near Batlow but there was no previous authentic specimen in the National Herbarium.

Cynanchum elegans, Mt Dangar, near Sandy Hollow. This climber had not been collected for more than a century. Search in its two original localities, Ash Island and near Cobbity, had failed to locate it.

Diuris pedunculata, near Tocumwal. Last collected on the western plains from near Hay in 1917.

Epipogum roseum, Mt Warning, near Murwillumbah. The third record for New South Wales of this epiphytic orchid, and the first since 1917.

Eucalyptus badjensis, Tuross Falls. A little-known forest tree species, growing on rugged country.

Eucalyptus multicaulis, Budawang Range, south of Sassafras. This "mallee-ash" has not been known south of the Sydney and Blue Mountains districts.

Grevillea renwickiana, near Nerriga. The first collection since 1915.

Herniaria hirsuta, 60 miles north of Wentworth. An introduced species. This small weedy species is a native of Europe and has been known in this State only from near Armidale. It occurs in South Australia.

Kennedia procurrens, Pilliga Scrub. Recorded for New South Wales but previously unsupported by authentic specimens. It was collected in 1951 but not identified until recently. The species occurs also in Queensland.

Lawrencia glomerata (formerly known as *Plagianthus glomeratus*), "Barrakee", near Bourke. This is only the second record for New South Wales, although the species has a wide range in the drier parts of Australia.

Leptomeria drupacea, Tuross Falls. Previously known only from a few localities on the northern and central tablelands and from Tasmania.

Leucopogon collinus, Nungatta Mountain, 20 miles south-southeast of Bombala. Though listed in the older literature this is the first authenticated collection from New South Wales in the National Herbarium. It is known from Victoria.

Olearia ramosissima, Fitzroy Falls. This was known from the northwestern slopes and plains and from Queensland.

Pluchea dentex, Gunderbooka, between Bourke and Cobar. The only previous record from New South Wales was from "Olive Downs", near Tibooburra. It occurs in Queensland and the Northern Territory.

Prostanthera stricta, Genowlan Mountain, 7 miles northeast of Capertee. The first collection of documented source since 1872, though plants are known in cultivation.

Prostanthera cryptandroides, The Gap and Sir John's Point, both near Glen Davis. This has not been recorded since the original collection by Allan Cunningham in 1825 from the "NW. branches of Hunter's River". It shows some floral features which are unusual in the genus.

Pultenaea platyphylla, Yerriyong, 8 miles southwest of Nowra. Known from more southerly and westerly localities.

Schoenus turbinatus, Point Plomer, 10 miles north of Port Macquarie. This sedge was not previously known north of the central coast and Blue Mountains.

Tricostularia paludosa, southeast of Nabiac. Otherwise known only from south of Gosford and the Blue Mountains.

Velleia montana, Clarence, Blue Mountains. There are only two other records from the Blue Mountains. It occurs also in the Australian Alps and in Tasmania.

Villarsia reniformis, Wingecarribee Swamp, near Moss Vale. The only record for this State since the last century, and the first from the tablelands. It has been found near Sydney and is well known in Victoria and Tasmania.

BOTANICAL EXCHANGES

Botanical Specimens.—The system of exchange with botanical institutions overseas and in Australia was maintained. Specimens received totalled 767 from oversea institutions and 1,657 from institutions in Australia and New Guinea. Specimens despatched totalled 480 to nine oversea institutions and 155 to three Australian institutions.

Photographs of Type-specimens.—Forty-five photographs of Type-specimens of ferns were received on an exchange basis from the Herbarium at Utrecht, The Netherlands.

Special Collections and Seed Exchange.—A large number of wood samples of *Acacia* species has been collected and sent to Professor D. G. Roux, of Bloemfontein, South Africa, for flavonoid analysis in connection with collaborative studies in the chemotaxonomy of *Acacia.*

Fresh, dried or fixed material of species of various genera has been specially collected and sent to botanists, chemists, and pharmacologists in Canberra and other States, and India, the U.S.A., and Britain.

Species of special interest, of which seeds were received, included *Telfairia pedata* the African "Oyster Nut". It is the basis of a promising minor industry in Rhodesia. Some are being raised at the Royal Botanic Gardens. Others have been sent for trial to the Division of Horticulture and the Queensland Department of Primary Industry.

A new issue of the *Index Seminum* has been prepared for distribution. It now lists, for each species, information on the precise source of seed available.

One hundred and fifty packets of seed were despatched to various oversea institutions.

The Botanical Collector.—The Botanical Collector spent 40 days in the field collecting some 60 lots of seed, about 1,650 herbarium specimens for record and exchange, and other plant materials specifically required for botanical research in the National Herbarium and to meet requests from other institutions. He conducted visiting botanists to suitable localities for their field studies.

Extended trips were made to the Braidwood-Currockbilly-Nerriga district, Abercrombie Caves and Crookwell district, Capertee Valley, north coast (Coff's Harbour-Yamba), and the northern tablelands (Glen Innes-Wallangarra). Shorter trips were made to the Blue Mountains, Kurnell, Royal National Park, Bargo, and Emu Plains.

Mr E. F. Constable retired on 11th June, 1968, after 22 years' service first as Seed Collector and later as Botanical Collector. He had discovered a number of previously unknown species and his collections contributed much valuable information on the distribution and variation of the plants of New South Wales and neighbouring areas. The species *Hakea constablei* commemorates his name.

BOTANICAL MATERIALS BORROWED OR LOANED OR DONATED

Herbarium specimens from southeastern Queensland donated by Mr C. Gittins contained many valuable additions to the collections. Further collections from Mr Gittins and from Mr I. Olsen, from central and north Queensland, the Northern Territory and Western Australia have been of considerable benefit in current research and will prove useful for future research and general reference and identification. They included wood samples and material for cytological investigation as well as herbarium specimens. Several undescribed species were among these collections.

A collection of 207 fern specimens presented by Dr A. Murray Evans, University of Tennessee, Knoxville, U.S.A., contained a number of species, especially from Jamaica, not previously represented in the National Herbarium.

A useful collection of *Eucalyptus* species from remote parts of Western Australia was presented by Dr J. Beard of the King's Park and Botanic Garden, Perth. Among them some new species were detected.

The collections of *Flindersia* were sent on loan to Harvard University, U.S.A., for use in revisionary studies. Twenty-seven other despatches of specimens were made on loan to 17 institutions in Australia and abroad. Specimens were borrowed from a number of institutions as required for research projects. Large loan collections of Restionaceae from the herbaria at Kew, Berlin, Melbourne, and Perth were returned. These had been of great assistance in research on the family.

PROFESSIONAL VISITS TO THE HERBARIUM

Again many notable visitors from overseas and from Australian scientific institutions were granted facilities for study at the National Herbarium and held consultations with the staff on matters relating to their particular studies. Botanists accompanied some of the visitors on short field trips.

Oversea visitors included: Dr C. den Hartog (Rijksherbarium, Leiden, Netherlands), studying water plants; Dr W. A. Weber (University of Colorado, Boulder, U.S.A.), working on lichens; Mr D. N. Henderson (Royal Botanic Gardens, Edinburgh, Scotland); Dr V. Zotov (D.S.I.R., Christchurch, New Zealand), studying grasses; Dr W. H. Hodge (U.S. National Science Foundation, stationed at Tokyo, Japan); Miss P. M. Bates (New Zealand Department of Agriculture), studying peatbogs; Professor T. Yamada (Chiba University, Japan); Dr S. Carlquist (Rancho Santa Ana Botanic Garden, California, U.S.A.); Dr R. Belcher (Eastern Michigan University, Ypsilanti, U.S.A.), working on *Senecio*; Professor C. D. Darlington (University of Oxford, England); Dr L. Bernardi (Conservatoire et Jardin Botaniques, Geneva, Switzerland); Dr N. T. Mirov (University of California, Berkeley, U.S.A.), who gave a lecture to staff and visitors on the genus *Pinus*; Dr R. Delepine (University of Paris, France), working on sub-Antarctic algae.

Visitors from Australia and New Guinea included: Dr P. Michael (Division of Plant Industry, CSIRO, Canberra); Dr R. D. Hoogland (Division of Land Research, CSIRO, Canberra); Miss J. Galbraith (Tyers, Victoria); Mr J. C. G. Banks (Forest Research Institute, Canberra); Mr G. Chippendale (Forest Research Institute, Canberra); Dr R. D. Johnston (Forest Research Institute, Canberra; Professor N. C. W. Beadle (University of New England, Armidale); Dr M. E. Phillips (Canberra Botanical Garden); Mr G. E. Baragwanath (Geological Survey of Victoria, Melbourne); Mr J. S. Womersley (Division of Botany, Department of Forests, Lae, New Guinea); Miss E. Canning (Canberra Botanic Garden); Mr A. P. Kershaw (Australian National University, Canberra); Mr I. H. Brooker (Australian National University, Canberra); Mr M. Lazarides (Division of Land Research, CSIRO, Canberra); Mr B. Henderson (Queensland Herbarium, Brisbane).

A number of botanists and other scientific workers stationed in Sydney also visited the Herbarium for study or discussions.

MISCELLANEOUS AND SPECIAL SERVICES

Dr Vickery was elected to membership of the Council of the Australian Conservation Foundation and attended the inaugural meeting in Canberra of the first elected Council.

Mr Johnson completed his term as President of the Linnean Society of New South Wales and presented his Presidential Address: "Rainbow's End: The Quest for an Optimal Taxonomy". This is being published in the Society's "Proceedings". It is a discussion of the philosophical foundations of taxonomy and of recent trends in the subject, especially the use of the mathematical techniques of "numerical taxonomy".

Mr Johnson continued to serve on the Parks and Reserves Scientific Committee set up by the Minister for Lands, and visited the Tibooburra and Colong areas in connection with the Committee's surveys. Mr McGillivray visited several proposed reserves on the north coast on botanical survey for this Committee. Mr Johnson also continued as a member of the Sim Committee on conflicts between mining and conservation interests on the north coast, which presented its report to the Minister for Lands and for Mines.

Dr Tindale continued to serve as Secretary of the Systematic Botany Committee of Section M of ANZAAS and attended the 40th ANZAAS Congress at Christchurch. She presented a paper there on "A Comparison between the Fern Floras of Australia and New Zealand". While in New Zealand Dr Tindale travelled extensively in order to make collections and field observations, especially of legumes, ferns, and orchids. She also paid working visits to the Botany Departments at the Universities of Auckland and Canterbury and to the Botany Division of the D.S.I.R. at Lincoln and Mont Albert. Dr Tindale also continued her membership of the Special Committee for Pteridophyta of the International Association of Plant Taxonomists.

Dr Briggs continued as a member of the Systematic Botany Committee and also of the Editorial Board of the international journal *Evolution*.

Mr Johnson gave evidence of identification of plant material in three cases involving prohibited imports.

Information and identifications were furnished to the Police Department and field inspections were made in connection with several criminal cases. Dr Tindale appeared as a Crown witness in one such case.

Lectures and talks were given by botanists and the Botanical Collector to various groups and institutions.

HERBARIUM LIBRARY

Library accessions for the year totalled 1,931 items (74 books, 1,240 issues of periodicals, 580 pamphlets, 28 maps and 9 microfiches). Thirty-three of the books were donated, by 15 donors. The material was catalogued, and 672 periodical articles were indexed. 1,727 items were loaned to staff members, including 953 periodicals, 219 books and 555 pamphlets. 177 items were loaned to other institutions. Some were sent interstate, to New Zealand, and New Guinea. Thirty-one publications were borrowed from other libraries for reference by staff members.

Royal Botanic Gardens

GENERAL

The Gardens retained good condition. Public enthusiasm and interest in the various activities was evident in the many favourable comments.

Improvements Effected.—The more important were as follows: complete restoration of the Pioneer Memorial (Sunken) Garden by renewal of sandstone paving, steps and sections of walling; piping of a section of the waterway through the Upper Garden as a preliminary to landscape modification in that area; reconstruction of drainage in the Lower Garden where the main stormwater line from the Ponds to Farm Cove has caused problems for some years; attachment of quantities of various native orchid species to large trees as a basis for the native orchid display which is being established, particularly for exhibition during the forthcoming International Orchid Conference to be held in Sydney in September, 1969; further reconstruction of walling and completion of laying of cut sandstone paving to the perimeter of the Main Pond in the Lower Garden; extension of exhibition plantings adjacent to the main entrance in the southeast sector and in other established plantings elsewhere; continuation of re-alignment, re-formation and kerbing of roads and footpaths in the Middle and Lower Gardens and the Garden Palace Grounds and the related re-grading and re-planting of adjacent shrubberies and lawn areas; re-formation and turfing of several large lawn areas adjacent to the main entrance of the Royal Botanic Gardens and the Garden Palace Grounds; continuation of replacement of expended galvanized water services with copper services; renovation and painting of the iron-picket perimeter fence along the Macquarie Street boundary of the Garden Palace Grounds; further extension of telephone communication to various work depots.

Fountains and Statues.—Certain functional deficiencies of the Morshead Memorial Fountain which rendered operation ineffectual for short periods were drawn to the attention of the design architects and rectified.

The Governor Phillip Fountain was steam cleaned and the reflecting base of the pools re-surfaced and sealed.

Nursery and Glasshouses.—Expansion of the range and quantity of material under production continued, with propagation and development of local and oversea introductions. Liaison and exchange of material with kindred institutions, local and overseas, have contributed significantly.

Maintenance of nursery stock continued at a satisfactory level. Ample material was provided for re-planting and landscaping, including about 100,000 bedding plants required for massed seasonal floral displays.

Public displays of selected flowering species, ferns and foliage plants were continued in the glasshouses as in former years. Several hundred new species and hybrids mainly in the families Orchidaceae and Bromeliaceae, introduced from various sources, were added to the collections. This further enhanced their botanical value.

The deteriorating condition of several very old glasshouses continues to penalize heavily the general appearance of this important display area, but it is envisaged that these will soon be replaced by a modern complex of environment-controlled glasshouses in a more prominent and accessible area to the public.

The usual provision of plants and floral decorations for Parliament House, as well as for the stand and official rooms at the Royal Agricultural Society's Easter Show, was continued, as was the supply and maintenance of such decorative material to Government offices.

Facilities for plant production continued to improve with extension of electronic misting for plant propagation, the use of plastic plant containers, and construction of various storage and plant protection facilities.

Royal Agricultural Society Awards.—Notable success was achieved in the Horticultural Section at the Sydney Royal Show with the first competitive exhibit of material by the Royal Botanic Gardens. The material was awarded eight Championships, 21 First and 24 Second prizes as well as the Stamford Bros Trophy for the most successful exhibitor in Foliage, Flowering and/or Berry Plant classes and other major awards for the best exhibits in particular sections of these classes.

Landscape Designing and Associated Services.—Diversion of the Senior Landscape Designer for duty in other senior posts for part of the year and secondment of the Landscape Designer to the National Parks and Wildlife Service for 6 months, prior to permanent transfer to that service, seriously affected the increasing work of this section.

Apart from directing landscape works associated with general development of various areas of the Royal Botanic Gardens and works approved by the Centennial Park Supervisory Committee for restoration and development of Centennial Park, the principal projects comprised: preparation of plans for modification of background plantings to floral areas in Centennial Park, re-grading and landscaping of embankments adjacent to the new Domain Baths construction, an additional entrance to the Gardens from Mrs Macquarie's Road, tree planting along the southern alignment of the Cahill Expressway, and landscape settings for the Registrar-General's Department building and the Public Library of N.S.W.

Site inspections were made and plans and/or reports were prepared for landscape development of: Bilpin Public School, the School for Deaf and Blind Children—North Rocks, the historic St John's Church, Parramatta, sports fields for Inverell High School and parklands for Camden and Singleton Councils.

Visits were also made and advice given on grounds development and maintenance problems to other authorities including: Prince Henry Hospital, Manly/Warringah Parks Committee, Avalon High School, Metropolitan Meat Industry Board, Macquarie University, Fairfield Council, Warringah Shire Council Administrator, Maritime Services Board, Royal Sydney Golf Club, and the Departments of Army, Air, Public Works, Child Welfare and Social Welfare, and Main Roads.

Educational and Extension Activities.—A further series of lectures was delivered by the Senior Landscape Designer to University of Sydney post-graduate students of town planning. A one-day school on landscaping was conducted for the Agricultural Bureau of N.S.W. at Cowra.

The Superintendent, Royal Botanic Gardens, delivered two illustrated lectures to the Coonamble Rural Science School for the University of New England and the Assistant Superintendent delivered an illustrated lecture to the Royal Horticultural Society of New South Wales.

Garden Study Tours.—The Royal Botanic Gardens continued to receive ever-increasing attention of student groups undertaking botany and associated study tours, particularly from the Universities of Sydney and New South Wales and the Ryde School of Horticulture. Numerous school classes from primary to secondary level also visited the Gardens for guided tours and other instructional work.

Conducted tours were also arranged for V.I.E.W. Clubs, Richmond Country Women's Association, Beecroft and District Garden Club, the Royal Horticultural Society of New South Wales, a group of visiting horticulturists from the Royal Horticultural Society, England, and student teachers from Balmain Teachers College.

Turf Demonstration Plantings.—These plantings, started in 1963, were further developed with additional species. They continued to be of value to specialists and the general public.

VANDALISM

Vandalism continued to be a problem. Public fountains and their surrounds received most attention.

A vandal responsible for repeated damage to descriptive plant labels was apprehended by police.

The Domains

GENERAL

Improvements Effected.—The more noticeable were: the continuing improvement in grassed areas, especially the playing fields; further planting along the eastern side of the Public Library; extension of the landscape setting for the Registrar-General building adjoining the Domain; removal of more of the formerly majestic Moreton Bay Fig trees which have declined in vigour over recent years, and the continued extensive pruning of others.

Public Library Area; Landscaping.—Plans have been prepared to improve the landscape setting along the Macquarie Street frontage of the Public Library, on land under Royal Botanic Gardens and Government Domain control. Raised garden beds and recessed public rest areas would be featured. Funds are awaited.

Domain Baths Area.—Constructional work is almost completed. Preliminary landscaping has begun. The Domain Baths (constructed and owned by the Sydney City Council) should be ready for the start of the 1968–69 swimming season. The matter of equitable responsibility for re-formation of roadways is unresolved.

State Office Block Area.—Maintenance of the landscape setting at the State Office Block is now an accepted responsibility of the Inner Domain staff. Complete re-laying of turf to one half of the lawn area affected by concentrated pedestrian traffic has been necessary. Modifications to improve the aesthetics of the area in general are to be made in the coming year.

Playing Fields.—Lunchtime winter sporting fixtures, now an established week-day Domain feature, continued. Patronage has increased and the playing fields have been in heavy demand. Not less than 178 Rugby League, 198 Soccer and 1,047 Basketball matches were played there in the past 12 months.

The grassed areas were used also for recurrent annual parades and assemblages associated with Australia Day, the Sydney Royal Show Procession, the Waratah Spring Festival, Apprenticeship Week and various other occasions.

Domain Lodge.—The Government Architect has prepared plans to restore the old stone residence at the Domain entrance near the Registrar-General's Department. The work should commence shortly.

Government House

Inner Domain gardening staff maintained Government House Grounds and provided floral decorations for within the building. Some ground improvements were effected, including mechanical aeration and fertilizing of lawn areas; re-soiling of floral beds; renewal of expended rose plantings; raising and re-grading the southern parade lawn and extension of heating to the glasshouse.

Admiralty House

Royal Botanic Gardens gardening staff maintained the grounds of Admiralty House, the Governor-General's Sydney residence, and provided floral decorations for within this building and Government House, Canberra.

Some pleasing improvements were made. These included removal of old and superfluous trees and shrubs throughout, and replanting with new material; modification to gardens; planting of surrounds to the new swimming pool, and extension of cut-flower plantings. The Commonwealth Government reimburses the State.

Centennial Park (including Queen's Park)

Centennial Park Supervisory Committee.—This inter-departmental committee of officers from the Department of Agriculture and the Premier's Department functioned from May, 1964, until the end of June, 1968. Committee personnel comprised:

Chairman—Dr H. J. Hynes, Director of Agriculture until retirement on 2nd April, 1965 (thereafter acting under an honorary appointment).

Members—Mr A. H. Nicholson, Premier's Department; Mr A. Pearson, Chief, Research Stations, and later Deputy Director-General of Agriculture (deceased 23–12–1966); Mr N. K. Golding, Chief, Research Stations, Department of Agriculture (vice the late Mr Pearson); Mr K. Mair, Director and Chief Botanist, Royal Botanic Gardens; Mr G. Grant, Superintendent, Royal Botanic Gardens (retired 13–6–1966); Mr W. R. Watson, Superintendent, Royal Botanic Gardens (vice Mr Grant, retired).

The committee was formed on the suggestion of Mr H. Heath, then a member of the Public Service Board, to discuss problems and offer advice on matters of restoration and development of the Park's facilities. There had been continued public concern with the condition of the area. Inauguration of the committee was coincidental with a new appointment to the position of Director and Chief Botanist (the executive officer controlling the Park).

With additional funds provided by the Government, a programme involving intensive action was adopted. There were highly beneficial results over the 4-year period. Certain major long-term items of development remain to be completed.

Features developed under the committee's policy are: complete restoration of the 2¼-mile horse-riding track adjacent to the Grand Drive; clearing of reeds and silt from five ponds (Nos 1, 2, 5, 6, and 12) and the turfing of newly-graded banks of these areas; filling-in of low-lying areas in the southwest corner of the park and the gymkhana ground, respectively, for landscaping and horse-riding; complete replacement of old wooden and corrugated-iron sheds, stables, and office in the Depot area by modern brick-and-concrete structures, and the provision of a strong security fence; provision of plant and machinery including tractors, land-grader, tower-wagon for tree pruning, portable welder, etc.; replacement of wooden park-rail fence around Queen's Park; restoration of stone-coping, and painting of iron picket fence around Centennial Park (this project to be completed in future years); a new fence surrounding the Bird Sanctuary; piping and pipe-and-chain guards against parking on grassed areas, as well as kerbing and guttering for the same purpose; and installation of spear-points and pump-and-engine for irrigation.

In all, $234,000 was provided by the Government to fulfil the Committee's recommendations over the 4-year period, and before the Committee ceased to function at the end of June, 1968, it submitted a final draft estimate for developmental works to be undertaken in the following year, under the control of the Director and Chief Botanist.

The value of the work of the Committee may be gauged by the immense improvement in the appearance of the Park, the public appreciation of the area as evidenced by attendances and complimentary remarks, and the developed high morale of the staff through the plans and funds devoted to the area.

In 1967–68 the Committee made nine inspections of the Park before the formal meetings at the Royal Botanic Gardens, and also held two special meetings to consider re-drafting Regulations. Special funds to the amount of $50,000 were budgeted for 1967-68 and a further $4,000 was provided by the Treasury to cover an emergency in relation to pond-clearing. The whole of the $54,000 for the year was expended. Allocations provided for purchase of plant, construction of a new office, surfacing the Depot yard, kerbing-and-guttering of roadways, pond clearing, restoration of perimeter fence, and drainage piping.

Maintenance.—Both Cenennial Park and Queen's Park maintenance were at a high standard throughout the year.

Floral areas created an effective continuous display. Special attention was given to playing fields. Various areas were aerated, limed and fertilized. Sections were topdressed with loam or renewed with grass sprigs or turf. Other fields were re-graded, turfed or topdressed. Only limited watering was possible but extended irrigation facilities are intended in coming years.

Plantings.—Over 200 *Eucalyptus maculata* ("Spotted Gum") trees were planted out in the northeast corner of Centennial Park, adjacent to the Ocean Street entrance and extending along Carrington Drive and Loch Avenue to Broome Avenue. This is a hill-top area exposed to southerly winds where "Spotted Gum" has grown vigorously. *E. sideroxylon* ("Mugga") planted here earlier did not thrive and has been replaced by *E. maculata.*

Some 300 *E. grandis* ("Flooded Gum") trees were planted out on the hillside to the south of Broome Avenue, and at an Arbor Day ceremony attended by hundreds of school children 100 *Pinus pinaster* ("Cluster Pine") trees were set out on the sandy ridge extending east of the Depot in the centre of the Park.

The shrubbery around the floral area between Parkes Drive and Pond No. 12 was redesigned and 90 advanced plants were set out.

Areas planted to grass or laid with turf included: a section along Oxford Street beside Centennial Reservoir No. 2, formerly occupied by a rockery which had harboured refuse; the sloping bank at the rear of the Depot building; a drainage area beside the stables; pond banks, and a portion of the Gymkhana Grounds.

Pond Clearance and Allied Works.—Pond No. 6, the highest of Centennial Park's 12 areas of water, had become excessively silted-up and the entry points heavily reeded over many years. Public Works Department cleared the northerly inlets during the winter of 1967.

The Centennial Park Supervisory Committee planned to use this Pond No. 6 as a reservoir from which to pump water to irrigate the riding-track and playing-fields. Accordingly funds were allotted for complete de-silting. An estimated 40,000 cubic yards of spoil was removed from the two-acre area and was used to fill low-lying areas of the Gymkhana Ground being prepared for horse-exercising activities. The banks of the pond were graded and planted with kikuyu turf.

Heavy rains during the de-silting held up operations and days elapsed before the accumulated water could be pumped to lower-situated ponds. Porous sands had been penetrated in the cleaning-out and action was taken to incorporate a natural-clay to prevent future draining away of storage water. In a dry spell this was done. Recent heavy rains have filled the pond.

Pump, engine and main to Pond No. 6 have been installed so that accumulated rain-water from this pond may be pumped to the riding track and playing fields if necessary. But a subsidiary supply for those areas has been connected from spear-points in a drainage basin at the centre of the Park.

Sporting Facilities.—Applications for use of the playing fields continued to increase and concerted maintenance attention to all such areas has become obligatory. Action has been taken to appoint a permanent groundsman-greenkeeper in place of the recently-retired honorary supervisor who had arranged bookings of grounds over the past 50 years.

The problem of irrigating the playing fields has received special attention. The at present limited watering will be augmented greatly by operating the irrigation scheme using the newly-desilted Pond No. 6 storage.

Permission was given for a new sporting activity in the Park, the Model Boat Club's sailing of model yachts up to 6 ft long. Pond No. 6 will be used for this. The visiting public have also shown great interest in this activity new to the Park.

Buildings.—The final stage in replacing old buildings in the Depot area was completed by construction of a brick-and-concrete office building at the entrance. The siting facilitates contact by the public with the administration of the Park.

Coincidental with construction of the office block the whole of the road surface therefrom, and the Depot yard beyond, were re-graded and a strong new bitumen surface was provided.

Public Works Department, using its funds, has undertaken construction of three toilet blocks (two in Centennial Park, including one at the children's playground area near Oxford Street and one on Depot Avenue, and the third at the children's playground area in Queen's Park near Darley Road). The designs were prepared by the Government Architect's Branch, for the Park environment.

Gymkhana Ground.—This is a large open area lying south of Pond No. 5, extending to the Grand Drive by the Darley Street entrance, and the McKay Oval to the west. For years part of the area has been used for gymkhana purposes, dressage exercises and, in 1967–68, for Mounted Police Troop daily exercises. Much of the ground was low-lying, and badly-drained.

In 1967–68 the area has received some 40,000 cubic yards of spoil removed from Pond No. 6, 6,000 cubic yards from the foundations of the Randwick Technical College, and 4,000 cubic yards from elsewhere. This was graded to a contour plan prepared by the Senior Landscape Designer. Fertilizer was applied and turfing has been started.

Roadways.—Kerbing of a further section of Parkes Drive, from the Grand Drive near Depot Avenue to the earlier kerbed portion crossing Dickens Drive has been undertaken by Public Works Department, using funds allocated by the Centennial Park Supervisory Committee. The kerbing will prevent parking of vehicles on the grassed areas adjacent to the central playing fields and lawns.

Cleveland Street traffic entrance to Centennial Park has been re-organized by the Department of Motor Transport following representations by that Department and the Police Department regarding hazards associated with the complex of roads at this point. Some public protest was received at the time of the change-over but the new conditions are operating effectively now.

Department of Main Roads has submitted a plan for circular roadways at the Ocean Street entrance to the north-east corner of Centennial Park. The plan would involve moving the stone-and-iron gateway on Oxford Street about 60 ft, into the Park along Loch Avenue, and affecting part of the landscape planting done this year.

Parking Control.—Control of illegal parking of vehicles on grassed areas continued to be a problem. Extension of the piping or pipe-and-chain type of control installed already in some areas is intended. Kerbing, as already installed in parts is another effective control. It will be extended as funds become available.

Fencing.—Restoration of the iron picket perimeter fence to Centennial Park had been continued. The section from Darley Road to the York Road entrance north of Pond No. 6 has been completed. Broken stone coping has been replaced by sandstone coloured cementing, and the iron pickets have been cleaned and painted.

Miscellaneous.—The Randwick Council presented an old stone horse-trough, from Gilderthorpe Avenue, Randwick. This has been installed beside the horse-riding track inside the Grand Drive, opposite the Obelisk Area.

Following a suggestion that Centennial Park staff would mow the grass on footpath areas outside the Park perimeter fence, Randwick is grading the area bordering Darley Road and turfing it.

Sydney High School authorities asked permission to develop another football field beside the MacKay Oval, and have had an area filled with spoil and graded. A buffer area between this field and the Gymkhana Ground will be maintained by Centennial Park staff.

New timber seats suitably designed have been installed in the shelter-shed between Ponds No. 5 and No. 12.

DIVISION OF MARKETING AND AGRICULTURAL ECONOMICS

General

STAFF

With deep regret the Division records the death of Mr J. R. Williams, Senior Clerk of the Division for many years.

The Division's professional staff establishment was reduced by one this year but in actual numbers the professional staff increased by five. At 30th June, 1968, there was only one professional vacancy.

A position of Supervisor of Research has been created. Dr C. D. Throsby has been promoted to it. This has significantly improved research supervision in the Division.

Two officers were on secondment to other organizations during the year. The Special Economics Research Officer (Irrigation) was seconded to the Water Conservation and Irrigation Commission until October, 1967. An Economics Research Officer was seconded to the Research and Consultant Division of the Public Service Board from January, 1968, initially for 2 years.

Six members of the Economics Research staff were undertaking post-graduate studies for Masters' degrees. Three others were undertaking post-graduate studies for Diplomas in Agricultural Economics at the University of Sydney.

Research

Seven major research projects were completed, and five new ones begun. Progress was substantial in 19 important continuing research projects. Work on four major projects ceased on the resignation or transfer of the officers responsible.

Details of major projects are as follow, classified by subject matter.

1. ECONOMICS OF PRODUCTION

(i) *General*

Enterprise Gross Margins for North Western N.S.W.—This project involves a survey of dry land and irrigated enterprises to determine costs and gross margins. Further objectives are determination of capital investment needed for different enterprises, and analysis of physical factors and management practices contributing to success. So far data have been collected from 37 farms.

Machinery Ownership, Operation, and Replacement.—Several smaller projects previously being undertaken independently have been incorporated under this heading. The most important of these was the project mentioned in last year's report, "Depreciation and Income Tax". A number of analyses have been completed relating to the likely effects of depreciation and averaging provisions of income tax law on investment planning. This project will continue, specifically in the area of machinery ownership and operation.

Capital Accumulation Amongst Beginning Farmers.—Income tax accounts from about 80 farms are being used. Three groups of War Service Land Settlement Schemes are being studied over the period from establishment (1949, 1952, and 1957 respectively) to June, 1967. Covariance analysis is being used to investigate an investment function, whilst stepwise regression is being used to study factors related to capital accumulation. This project should be completed during 1968–69.

Survey of Pasture Problems on the North West Slopes.—This study was referred to in the 1966–67 report and is nearing completion. About 350 landholders in the Ashford Shire, northwestern New South Wales, have been surveyed by mail during the year in an attempt to define farming problems in the area. This study should throw light on the reasons for slow farm development there.

Economics of Soil Erosion Control.—The basic work is collection of information relating to the economic implications, at the farm level, of controlling or not controlling soil erosion. The project involves three sections, as mentioned in last year's report. Owing to a re-scheduling of priorities the project made little progress this year. However, the greater part of the study should be completed during 1969.

Farm Management Accounting in Practice.—This project was continued. A paper was prepared on some aspects of group accounting. Also, draft paddock and livestock registers were produced. These ultimately will supplement the Farm Record Book currently published by the Division.

(ii) *Sheep, Wool, Mutton, and Lamb*

Regional Studies of Mutton and Lamb Production.—This project, financed by the Australian Meat Research Committee, started in April, 1968. It is aimed initially at studying uncertainty in relation to mutton and lamb production. Two aspects are being examined: prices and input-output relationships.

Prices received for lambs, hoggets, wethers, and ewes marketed at Homebush for the period since 1945 are under detailed examination. Price fluctuations have been examined both within years and between years. The trend of prices over the whole period and the possible existence of a cobweb cycle for sheep have been examined, towards constructing a predictive model.

Published experimental work on the technical relationships involved in mutton and lamb production is being examined with respect to the adequacy of the information it supplies to the decision-maker at farm level. The problems involved in generating this type of information with respect to the grazing animal are also being studied.

In the next stage the project will comprise an attempt to develop a price-predictive model for the four categories of sheep mentioned earlier, and a continuation of assessment of theoretical and practical problems involved in using experimental data to derive input-output relationships required by producers.

(iii) *Dairy*

Evaluation of the Farm Feed-Year Assistance Scheme, Far North Coast.—The scheme operating on the north coast since October, 1966, reimburses farmers 50 per cent of the cost of developing improved pastures and crops up to a maximum of 20 acres per year and also meets a $5 per acre establishment cost in the first year.

The project started in 1968 is to evaluate the on-farm effects of this scheme. A survey of dairy farmers supplying the Norco factory at Lismore is being undertaken, to collect butterfat figures for each farm for the last five years. Net income figures will be analyzed from income tax returns, and sociological changes will be ascertained from personal interviews with farmers.

Optimum Feed-Year Programmes, North Coast.—This major continuing project has progressed. Construction of an initial working model to examine the dairy farm feed-year planning problem has been completed. Linear programming models are being formulated on the basis of the available data, to devise optimal feed-year systems for a range of representative farm situations. The models are designed to allow free choice of:

(a) pasture and fodder crop species;
(b) a range of nitrogen fertilizer top-dressing programmes;
(c) a range of cow yield levels, calving patterns and herd sizes;
(d) a range of grazing and conservation patterns;
(e) purchased feeds if necessary.

Solutions will be dictated by resources such as available land, labour, and capital as well as by factors such as the appetite of the cow, the digestible organic matter required through the season for maintenance and milk production, and by the general level of prices.

Farm Development Plans; North Coast Dairy Farms.—The objectives of this project were set out in last year's report. Little progress has been made this year, owing to pressure of other work on the officer.

Whole-farm Studies; Far North Coast.—Progress has been considerable this year, with emphasis on a farm management analysis of the financial records for each year of development on the individual farms. Profit-and-loss statements for each year of development have been prepared showing: (a) individual enterprise gross margins; (b) total farm gross margins; (c) operating return; (d) return to total assets. Also, cash flow statements have been prepared for comparisons of various overdraft situations.

The project has already enabled the officer concerned to give detailed farm management planning advice to all the co-operating farmers. A number of extension reports have been prepared, as well as a detailed report on physical and financial results to the end of 1966–67.

Dairy Herd Replacement Economics.—A field survey was conducted this year amongst near-Sydney dairy farmers. The results have been analyzed to determine the economic efficiency of alternative systems of herd replacement. This project is thus now virtually completed. An extension-orientated article will be produced early in 1968–69.

(iv) *Beef*

Beef Cattle Industry, Especially in Northern N.S.W.—This continuing project is supported by the Australian Meat Research Committee. It involves economic investigation of production problems in the beef industry in northeastern New South Wales, and co-operation with technical research personnel at Grafton Agricultural Research Station in development of pasture improvement programmes for beef producers in the area. Much progress has been made. Six papers were published in the past year.

Growth of the farm firm has been studied in relation to such factors as rate of capital accumulation, managerial ability, and rate of adoption of new techniques. Two sub-projects have been commenced: (a) a case-study to examine the possibilities for building up cattle numbers during a pasture improvement programme, using dynamic linear programming methodology; (b) a survey of agronomic, economic, and sociological factors of superphosphate usage in the Clarence valley.

(v) *Poultry*

Poultry Management in the Sydney Area.—The study was completed this year. A Divisional *Miscellaneous Bulletin* reporting the results was published. An article was prepared also for the *Agricultural Gazette of N.S.W.*, detailing some conclusions of special interest to poultry farmers. A full description of the study was in last year's report.

Chicken Meat Production in N.S.W.—This economic study was commenced in January, 1968, in co-operation with the Division of Animal Industry. It is a response to requests from the Broiler Growers' Association of New South Wales and other interested parties. The objective is to determine the general management and economic structure of broiler growing enterprises, to isolate specific problems and study the effects of price changes on farmers' income.

A stratified random sample of 77 farms has been drawn from the population of about 400 farms of capacity greater than 9,000 birds. Costs, returns, and management details are now being obtained.

(vi) *Fruit and Vegetables*

Banana Farm Management Study.—The aim is to identify more clearly the farm management problems confronting banana growers, with a view to providing information for growers on the likely results of changing their farm organization. A mail survey covering 386 New South Wales growers has been undertaken; about 64 per cent of the sample returned the survey questionnaire. The data are currently being prepared for analysis.

(vii) *Irrigation and Flood Mitigation*

Proposed Irrigation Scheme, Barellan District.—The major part of this project has been completed. Variable resource linear programming has been used to evaluate profitability of the co-operative private irrigation scheme. Results at both theoretical and practical levels have been interesting. A report is in preparation.

Demand for Water in Cotton Production.—This study is an attempt to estimate the demand for irrigation water in the Namoi Valley area, and to evaluate the economic effects of alternative irrigation water pricing-policies on resource-use there.

Problems involved in pricing public water supplies are being investigated, and the adequacy of the present pricing policies in the Valley are being assessed. A major review of the literature of price policies for public utilities has been completed. The next step is actual estimation of demand functions for water. One paper relating to this project was produced this year.

Income Uncertainly of Vegetable Production under Irrigation.—Work has started on this project, with particular reference to the Mudgee district. It is to provide information for benefit-cost estimates for proposed State water storage projects, and information for extension purposes in areas where vegetable production may be introduced or expanded through irrigation.

Initially, farm income patterns over time are being estimated for a selection of enterprises on farms suitable for vegetable production, using cash-flow budgets. A linear programming model is to be used for two selected farms representing the two relevant major soil classses (alluvial flats and gently sloping country) in the Cudgegong Valley.

Economics of Flood Mitigation; Lower Hunter.—This is a benefit-cost study of recent Department of Public Works flood mitigation constructions at Swan Reach in the Hunter Valley. The study was started in 1965–66 at request of the Department of Conservation but could not be completed until necessary hydrological data was available from Department of Public Works. This is now available and the project has been re-opened.

Large Area Farms; Murrumbidgee Irrigation Area.—This study, described in the 1965–66 annual report, has now been largely completed. A detailed paper reporting the research results is in preparation. Parametric linear programming facilities on the University of New South Wales computer were used to derive optimum farm programmes for 584 different resources situations. These were: (a) one, two, three and four permanent men; (b) farm size from 300 to 1,400 irrigable acres in increments of 40 acres; (c) institutional rice restrictions of 50, 60, 70 and 80 acres; (d) haymaking activities using assumptions both of machinery ownership and of contracting.

Two measures of optimum farm size were used. The more significant of these was the percentage net return to capital and management. The other criterion was minimum total cost per dollar of gross income.

One conclusion of the study was that rice growing will continue to form part of optimum farm programmes, given likely price movements in the foreseeable future.

Several more research papers relating to this study will be prepared.

Coleambally Economic Study.—This continuing project progressed. Records collected this year from the 18 co-operating farmers included details of all farm income and expenditure, an inventory of assets and liabilities, and details of all farm programmes. All the data up to the end of the 1965–66 financial year have now been tabulated and analysed.

The following information has been compiled for each farm: operating and capital expenditures; gross income; cash balances; growth in assets, liabilities and net worth; net farm income; total capital investment; net return to capital and management; net return to net worth. These data are to be published in due course in the Division's *Miscellaneous Bulletin* series.

Moira Irrigation Scheme and Farm Management Study, Berriquin.—These two studies, detailed in previous reports, have been completed. In each a considerable amount of linear programming calculation was involved. The final report for each should be compiled during 1968–69.

2. MARKETING AND POLICY

(i) *General*

Economic Appraisal of Forward Markets.—This project is largely complete. Extensive theoretical analyses were undertaken, based on the principle of the efficiency of use of information resources, using the concept of social cost. The conclusion was that contracts generally result in a significant improvement in economic efficiency.

Part of the project has involved a re-appraisal of the current approach to marketing theory. One paper derived from this project has been published and another is in preparation.

(ii) *Cereals*

Wheat Segregation Economics.—This major project is nearing completion. It aimed at assessing whether the segregation of New South Wales F.A.Q. wheat into classes with different baking qualities would significantly assist the Australian Wheat Board in merchandising the wheat. The two proposed grades are "New South Wales Hard" and "New South Wales Soft".

An attempt has also been made to assess whether the additional financial returns to growers would exceed the costs of segregation.

The project has shown that segregation would increase the gross returns receivable from the sale of New South Wales wheat, besides improving its value to buyers. "New South Wales Hard" could receive a premium of between 4 and 10 cents per bushel above the F.A.Q. price, whilst "New South Wales Soft" would fetch about the F.A.Q. price.

It would appear feasible to segregate New South Wales F.A.Q. wheat at most receival stations. Segregation costs would increase total costs of marketing by about one-half cent per bushel segregated.

The conclusion is that segregation along the lines studied would be beneficial in the northern and central areas of New South Wales. The situation in the Riverina could not be conclusively assessed.

One paper from this project was published this year. and a major report is in preparation.

(iii) *Eggs*

Domestic Demand Structure for Shell Eggs.—Work on this project, described in previous annual reports, has been temporarily suspended because the officer is now full-time on another major project. But this year some method problems impeding the study have been overcome. Work on the project should recommence in 1968–69.

(iv) *Dairying*

Factors Impeding Adjustment on Low Income, Far North Coast Farms.—This project started in June, 1967, in general to further economic investigations of the far north coast dairy industry which have been in progress for the past eight years.

Reviews of the literature relating to low-income farming in Australia and other countries have been completed. Time series data reflecting the general rate and direction of farm adjustment have been analysed for 20 areas on the far north coast of N.S.W. Changes in the distribution of dairy herd sizes have also been analysed.

The principal conclusion from all of these analyses is that while some change is taking place, it has not been sufficient to offset a decline in returns to resources.

Studies of resource productivities, and further development of previous research, have led to the conclusion that adjustment has been prevented typically by lack of profitable adjustment alternatives. This situation may now however be changing because of the advent of new technology for dairying in the region. Aspects of this question are currently under study.

In addition it is proposed to conduct a survey of recent land sales in the area, in order to determine the characteristics of farms and farmers selling out.

The project has given rise to one published paper this year.

(v) *Methodology*

Method Studies in Dynamic Models of Production.—This continuing project has progressed. Theoretical studies were carried further into the nature and construction of multi-stage linear programming models of use in farm planning. Refined procedures have been developed for setting up these models, such that computational time could be considerably reduced.

Comparative studies examining the relationship between conventional and newer models in this sphere were undertaken. These highlighted practical limitations on the eventual field use of their techniques.

Two papers arising from this project were published this year. Also, a textbook in the general area has been written by the officer responsible for the project. The text book went to press towards the end of 1967–68.

Computer Programming.—In this as in previous years, one officer has been responsible for providing advice and assistance on all computer programming matters. Programmes written this year for use at the Treasury A.D.P. Service Centre are as follows:

(a) ALPCRD, to read data cards previously used on superseded linear programming systems and to produce data cards for newer systems;

(b) AMCALO, to read data from any format and prepare a binary tape usable by the regression programme ABRA;

(c) AMCAL1, to process data collected in a study of the far north coast dairy industry;

(d) AMCAL2, to convert data cards from the form required by programme AMERSHEM to the format required by ALPS;

(e) AMCAL3 to calculate present values for a series of cash flows at different discount rates.

Several simplified manuals describing the use of various programmes for common problems were prepared this year and distributed to a number of Departmental users of computers.

Experimental and Statistical Methods in Response Surface Estimation.—This project has this year provided for Departmental research officers the basis for several seminars and been indirectly implicated in various discussions the officer responsible has had with officers of the production Divisions on research matters.

Theoretical work was begun during the latter part of 1967–68 on the reconciliation of statistical and economic requirements in response surface estimation. Planning was commenced on an empirical study in this field which is to be implemented in 1968–69.

Advisory, Educational and Extension Activities

PUBLICATIONS

Review of Marketing and Agricultural Economics.—Publication of this quarterly journal has been continued by the Division. As from the March, 1968, issue the format and layout have been modernized. There is considerable improvement in the appearance.

The recently appointed Supervisor of Research has been appointed Editor, assisted by an editorial committee chaired by the Deputy Chief of the Division.

The *Review* circulates widely amongst professional agricultural economists and agricultural administrators in Australia and overseas and is an important disseminator of research results in all aspects of agricultural economics and the marketing of farm products. There has been marked increase in flow of material to the *Review* for publication. This has improved the standard of contents and the publication schedule.

New "Miscellaneous Bulletin" Series.—A new, processed publications series was introduced this year primarily as means of publishing detailed factual reports on farm surveys and other economic investigations Two such bulletins have been issued so far. Copy for two more is now being edited for publication during 1968.

New "Farm Planning Leaflet" Series.—A series of extremely useful factual bulletins is now being issued from the Leeton Regional Office. Success of the series is such that its extension to other Regions where Economics Research staff are employed is being arranged. It is anticipated that during 1968–69 *Farm Planning Leaflets* will be issued from at least three Regional centres.

Australian Bibliography of Agricultural Economics, 1788–1960.—Prepared by two former officers of the Division, this Bibliography has now been published by the N.S.W. Government Printer and is on sale. The Bibliography provides, for an indefinite period of the future, a comprehensive reference source for research workers in all aspects of agricultural economics.

Weekly Marketing Notes.—This and other publications giving information on prices of rural produce sold at the various Sydney wholesale markets have continued without change.

EXTENSION SERVICES IN FARM MANAGEMENT

The Division continued to provide schools and courses in farm management economics for the farming community but was unable to meet fully the demand for extension education in farm management with existing staff.

Besides lecturing at the already mentioned farm management schools, officers of the Division addressed a number of schools and conferences organized by the Agricultural Bureau, the universities and other organizations. Officers also addressed various professional societies on economic aspects of the rural industries.

For staff reasons it also has not been possible to make any significant progress with Divisional plans in relation to regional extension services in farm management. It may be several years before comprehensive services can be provided. Development of these services will depend almost entirely on the Division's retention of agricultural economists who are now obtaining background and experience in farm management work.

In answer to the need to recruit further staff the Division has not less than 17 undergraduate trainees in Agricultural Economics at the University of New England and University of Sydney.

UNIVERSITY AND COLLEGE LECTURING

At Universities.—Several officers of the Division have given part-time courses in various aspects of agricultural economics to students at the University of Sydney and University of New South Wales. One officer gave a short course in the economics of wool and wool marketing to students of wool technology at the University of New South Wales. Another provided a course in production economics and linear programming to final year students in the School of Wool and Pastoral Science at the same university. He also gave two series of lectures to students at the University of Sydney; one to a group in the Faculty of Veterinary Science and another to post-graduate students in the Department of Town and Country Planning.

Another officer gave a series of lectures in welfare aspects of water resource development to students in water engineering at the University of New South Wales and towards the end of the year two other officers had commenced lecture series to students in agricultural economics at the University of Sydney.

At Agricultural Colleges.—The Division continued to provide a full-time lecturer in agricultural economics and farm management at Wagga Agricultural College. This year a full-time lecturer was also appointed, on secondment from the Division, to lecture in the same subjects at Yanco Agricultural College. Previously the lecturer at Wagga Agricultural College in agricultural economics and farm management also lectured at Yanco, on a visiting basis.

POLICY ADVICE

The Division continued to provide advice on economic policy affecting agriculture, and to examine and advise on the position concerning imports and exports of coarse grains, protein concentrates and other farm requisites. Policy issues relating to the potential expansion of grain sorghums and other coarse grain production and export were reviewed.

The Deputy Chief of the Division was appointed by Cabinet to be chairman of a small advisory committee to "Examine the effects of the devaluation of sterling and other currencies on the primary export industries of the State and to make recommendations to the Government on measures necessary to alleviate hardship resulting from devaluation". Other members of the advisory committee were Mr J. W. Davies, Assistant Under Secretary (Budget and Inspection), The Treasury, and Mr W. H. Bentley, O.B.E., a Chartered Accountant, with long and close association with rural industries.

The Committee has presented to the Government a series of 13 comprehensive reports covering all important rural export industries.

Marketing Boards and Polls

The Division is responsible for the administration of the Marketing of Primary Products Act, 1927–1965, and in particular for the conduct of producer polls arising from this Act.

The Egg, Rice, Wine Grapes, Lemon and Tobacco Leaf Marketing Boards constituted under the Act continued to operate and fulfil their statutory obligations.

The Citrus Fruits (excluding Lemons) Marketing Board for the Shire of Wentworth and that portion of the Shire of Balranald within the County of Taila, constituted in 1966, has not as yet shown any marked activity.

The Citrus Fruits (excluding Lemons) Marketing Board for the Shires of Gosford, Wyong, Lake Macquarie, and the City of Newcastle, constituted in 1967, is functioning under the name of Central Coast (Citrus) Marketing Board. Formal approval to use this name is still pending.

A number of regulations made under the provisions of the Marketing of Primary Products Act, 1927–1965, were amended this year. Among these were the General Regulations relating to the definition of producers of citrus fruits (excluding lemons), and to allowances payable to members of the Tobacco Leaf Marketing Board, also certain regulations relating specifically to the Egg Marketing Board and the Rice Marketing Board.

Three polls were held under the terms of the Marketing of Primary Produce Act, 1927–1965. These were for the initial election of producer representatives to the Citrus Fruits (excluding Lemons) Marketing Board for the Shires of Gosford, Wyong, Lake Macquarie and the City of Newcastle; the triennial election of producer representatives to the Rice Marketing Board and the triennial election of producer representatives to the Egg Marketing Board.

Preliminary work was undertaken in connection with the triennial election of producer representatives to the Tobacco Leaf Marketing Board and to the Wine Grapes Marketing Board for the Shires of Leeton, Wade and Carrathool.

Marketing Reports and Related Services

Reporting.—The Division fulfilled a statutory function relative to the Marketing of Primary Products Act, 1927–1965, by continuing to collect and disseminate detailed wholesale-market information.

Reports covering supplies, quality, price, and price movements, at the City Municipal Markets (fruit, vegetables, poultry, fish, and cut flowers), at Homebush (cattle, sheep, and pigs), at Alexandria, Perry Park, and Sussex Street (grain, forage, and hard vegetables) were provided each day the various markets traded.

Press and Radio Daily Service.—Market information provided by the Division was broadcast daily by the Australian Broadcasting Commission, including regional relays and interstate hook-ups, and by some commercial radio stations. The daily press, periodicals, Federal and State government departments and instrumentalities, producer organizations, etc., were furnished with detailed marketing information through the *Daily Wholesale Price Quotations.*

Monthly Surveys.—Monthly surveys of wholesale and retail stock-feed prices and wholesale prices of dressed poultry were continued.

Inter- and Intra-State Supply Trends.—Records of arrivals into Sydney by rail and sea, of various primary products from inter- and intra-State sources, were maintained.

General Information Service.—Numerous requests were received from State and Federal government departments, banks, and private individuals (in Australia and overseas) for information about prices and prospective markets for an extensive range of primary products.

Crop Review and Forecasts.—This service continued. Production forecasts were prepared for wheat, oats, citrus fruits, and broom millet.

The regular monthly survey of *New South Wales Pastoral Conditions* and the *Report on Production Trends* continued to be published. As already indicated, the publication of *Weekly Marketing Notes* continued unchanged.

Representation on Committees

The Chief of the Division continued as New South Wales Government representative on the Australian Tobacco Board, with the Deputy Chief as alternate member. The Chief and the Deputy Chief were members of the Australian Organizing Committee for the 13th International Conference of Agricultural Economists, and the Deputy Chief was acting Chairman of this committee from the beginning of 1968 until its affairs were terminated in June, 1968. The Deputy Chief was responsible for organizing on behalf of the Committee all tours and excursions operated during and after the conference.

As reported earlier the Deputy Chief was in November, 1967, appointed chairman of a committee set up by Cabinet to examine and report on the effects of devaluation on the primary export industries. He also continued as Chairman of the Yass Valley Technical Advisory Committee of which another member of the Economics Research staff is Secretary, and he remained Executive Officer of the State F.A.O. Committee.

Another Economics Research Officer acted as Secretary to the Cabinet Sub-Committee on Drought Relief and Secretary to the Standing Committee on Drought Relief, in each case until February, 1968.

The Senior Clerk continued as Departmental representative on the Markets Advisory Committee.

13th International Conference of Agricultural Economists

The 13th International Conference of Agricultural Economists was held in Sydney in August, 1967. The Conference was organized on behalf of the International Association of Agricultural Economists and was attended by approximately 500 agricultural economists from all parts of the world. About 300 of the delegates were from overseas.

Some officers of the Division participated extensively in the organization of the Conference and almost all officers were able to attend it. The benefits from contacts made with overseas agricultural economists through the Conference will be of longstanding value.

DIVISION OF INFORMATION SERVICES

Amended Composition and Scope

EFFECT OF NEW DIVISION OF EXTENSION SERVICES

In December, 1967, the Public Service Board approved a Departmental recommendation initiated by the Chief, Division of Information Services. This comprised transfer of some sections of the Division of Information Services for amalgamation with the Regional Extension Services—to form a Division of Extension Services under the control of the until then Acting Chief of Regional Extension Services. The transfer and amalgamation took effect in January, 1968.

Sections transferred from Division of Information Services were as follows:

- the Agricultural Bureau of N.S.W., and allied Group Extension activities;
- the Women's Extension Service;
- the Audio and Visual Aids Services;
- appropriate clerical, shorthandwriting/typing and office-assistance staff;

together with responsibilities for extension aids/equipment supplies throughout the State and the in-service training schools on extension principles/methods.

In terms of personnel, the transfers were as follows:

Special Extension Officer (Agricultural Bureau and Group Work)	1
Extension Officers (Agricultural Bureau)	3
Extension Officer (Organizer of Short Schools/Courses)	1
Senior Extension Officers (Women's Service)—the O.I.C. and the other Senior	2
Extension Officer (Women's Service)	1
Extension Officer (Photographic and Allied Aids)	1
Extension Officer (Radio)	1
Extension Officers (Display Artists/Designers)	2
Technical Assistants in Audio/Visual Aids	2
Senior Clerk	1
Junior Clerk	1
Female clerical, shorthandwriting, typing staff	6

The Division of Information Services now comprises the following:

- Editing services.
- Research Liaison (Science Publications) services.
- Library services.
- Enquiry Counter and Publications Distribution services.
- Home Gardens Advisory Service (by secondment from Division of Plant Industry).

External Courses in Extension Principles/Methods

Although released from responsibility for in-service extension principles/methods training, responsibility which started in 1947, the Chief of Division of Information Services (C.D.I.S.) continued to be made available for external courses.

Extension Training for Overseas Personnel

The Commonwealth Department of External Affairs with the Australian Agricultural Council as co-sponsor, staged from September to November, 1967, a 10-weeks training course for overseas extension personnel. Twenty-two extension workers from Afro/Asian/South Pacific countries comprised the visiting Fellows.

The C.D.I.S. provided by invitation the initial working papers (200 pages, quarto)* for this course; also the foundation address on "Extension definitions, philosophies and trends" and the basic week on "Human Relations in Extension". Commonwealth, Victorian, Queensland and South Australian authorities shared with N.S.W. the responsibilities for the remainder of the course.

Department of External Affairs with the Australian Agricultural Council as co-sponsor subsequently organized a similar 10-weeks course to occur in the 1968 spring; the C.D.I.S. to provide the foundation address and the basic first week as in 1967.

Courses for University Undergraduates

Second Year Undergraduates.—The C.D.I.S. continued to provide for second year undergraduates in the University of Sydney School of Agriculture a one-week school and an examination on extension principles/methods. This was by invitation from the University of Sydney Faculty of Agriculture.

Fourth Year Undergraduates; Optional Course.—Also by invitation from the University of Sydney, the C.D.I.S. provided for fourth year students in Agronomy a 30-hours course (18 lectures and 12 seminars) and an examination in extension principles.

Sectional Reports

EDITING SECTION

The Range of Miscellaneous Publications

There are now 1,364 titles in this range, as against 1,219 a year ago.

The Editing Section sent 248 jobs to the printer, compared with an average of 212 per year for the previous 6 years. The printer delivered 269 jobs, as against 323 in 1966–67 and 240 in 1965–66. At 30th June, 1968, there were 107 jobs at the printery, as against 56 a year earlier.

Some 296 publications are in need of reprinting when revision and editing have been accomplished. Of these, 28 have been revised by authors and await editing attention; 158 are with authors for revision, and 110 are being held in the Editing Section because if these were now sent to authors for revision this would probably have to be repeated by the time the editing staff could handle the editing.

At the end of 1966–67 there were 273 in need of reprinting when revision and editing could be accomplished, with 41 of these actually revised and awaiting editing, 135 with authors for revision and 97 held back in the Editing Section.

Press Copy (weekly broadsheet) and Press Releases

"Press Copy" (weekly sheet).—This was discontinued immediately after the issue dated 6th October, 1967. Increased effect of Regional publicity services to newspapers, radio and television stations is one reason for this decision. Another is that State Office Block facilities for processing individual releases speed up the release of *news* by comparison with the more costly weekly printed broadsheet.

Press Releases.—Fifty-nine releases were made, as against 48 in the previous year. Many were from the Minister's office. Rate increased notably in the final quarter of the 12 months under report.

Miscellaneous Periodicals

"Dairy Topics (bi-monthly).—Seven issues were the target for 1967–68, to overtake the lag of one from 1966–67. Seven were produced and delivered.

The year's issues averaged 22.5 pages and 7 articles, as against 21 pages and 6 articles per issue in the previous year. Of the 49 articles in the seven issues, 41 originated in Division of Dairying, and one each in Division of Animal Industry and Division of Plant Industry, whilst five were from outside the Department.

A change in cover design has provided more flexibility in choice of photography and reduced the printing costs, whilst retaining the familiar character.

Poultry Notes (quarterly).—The required four issues were produced and delivered; the fourth in April.

Veterinary Notes (quarterly).—The goal of four issues was achieved.

The Agricultural Gazette of N.S.W. (Monthly)

Thirteen issues were a 1967–68 target, to overtake a delivery lag of one from 1966–67. The 13 were delivered within the 12 months. Timeliness, within the nominal month for the issue, was another goal. There was some success. First copies of eight issues were delivered by the printery in the correct month. For the other five the greatest lag was two weeks into the wrong month.

A new service in the Gazette this year was publication of lists of the miscellaneous extension literature received from the printery at intervals throughout the year. Details of edition numbers were included. Responses from Gazette readers indicated a place for this service.

The *Research Section* of the Gazette averaged seven pages per issue, as in the previous 2 years.

Gazette mailing list additions and deletions resulted in a net gain of 3,017 addresses, as against 1,992 in 1966–67 and 1,800 in 1965–66. Part of the increased rate of gain was undoubtedly due to publication of an application form in two issues of the Gazette. Readers apparently drew this to the attention of other people. For 3 months following the first of these inclusions the net gain of addresses has averaged 427 per month.

The Gazette mailing list now requires a monthly minimum printing of 24,000 copies.

"Research and the Farmer" (Regional series; irregular)

No new issue in this series was achieved. Material for a new issue from North Coast Region is in preparation, dealing with tropical fruits research in particular.

Text Books/Farmer Handbooks

"Weeds" Book (J. N. Whittet).—Final proofs of the 2nd edition are at the printery. Delivery of this major sales publication is expected to occur early in the 1968–69 fiscal year.

"Pastures" Book (J. N. Whittet).—All text for the 2nd edition was at the printery by February, 1968. When proofs are received the indexing and related work can proceed.

"Trees of N.S.W." Book (R. H. Anderson).—Final proofs for the 4th edition were returned to the printery in April, 1968. Delivery of the edition early in the 1968–69 fiscal year is expected.

"Dairy Farming in Australia" (N.S.W. 2nd Edition).—By February, 1968, all new and revised copy for the 2nd edition of this Commonwealth book were submitted to the Department of Primary Industry, Canberra, for processing.

RESEARCH LIAISON SERVICE (SCIENCE PUBLICATIONS)

The one Research Liaison Officer (Science Publications) position in the Division was vacant from June, 1967, to February, 1968. It is now occupied by a young graduate in Agricultural Science for whom suitable induction training and experience has been organized.

This officer was given induction experience through work on the *Research Pars* segment of the Gazette, and in other ways including 2 weeks attachment to the production office of the *Australian Journal of Experimental Agriculture and Animal Husbandry* in Melbourne.

Public Service Board approval has been sought for 6 months attachment of the officer to that Melbourne production office, dating from August, 1968. In this proposition, initiated in collaboration with the Editor of *A.J.E.A. & A.H.* is the genesis of a system whereby to provide in Australia a "training area" for future science editors/science journalists. If successful this system would meet a need that is readily apparent to scientists and the professional staff of journals serving them.

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* Since processed by Department of External Affairs as a manual: "Reference Papers and Notes for Lectures, Discussions and Seminars; for Use in a Training Course in Agricultural Extension for International Fellows Studying in Australia".

INQUIRY COUNTER AND PUBLICATIONS DISTRIBUTION SECTION

Inquiries Serviced.—Excluding the Home Gardens Advisory Officer (H.G.A.O.) work reported in a later paragraph, the Inquiry Counter office assistants handled 32,365 requests; compared with 42,197 in 1966–67 and 42,301 in 1965–66. Some reduction of total was expected; as a temporary effect of change of address from Farrer Place to the State Office Block and as an effect of the series of postal employee strikes during this year.

Of the 32,365 requests: 10,705 were telephoned, compared to 8,673 in 1966–67 and 8,433 in 1965–66; 6,355 were postal, compared to 14,966 in 1966–67 and 16,043 in 1965–66; and 15,305 were in-person, compared to 18,523 in 1966–67 and 17,825 in 1965–66.

Notably, only two in lieu of three office assistants now service the inquiry counter. In part this reflects improved facilities—through location in the State Office Block, and in part the cumulative effect of the continuing swing noted in recent years' reports; the increased use of country offices by rural inquirers.

Publications Distribution.—The office-assistants and attendant dispersed 871,203 publications; compared to 829,025 in 1966–67, 760,699 in 1965–66 and 860,128 in 1964–65.

In the 871,203 were 175,771 direct to the public in response to telephoned or postal or in-person inquiries, 78,321 by servicing libraries and Departmental offices in the "New/Revised/Reprinteds" mailing list, and 617,111 by bulk-parcelled responses to Regional offices' orders.

SALES OF PUBLICATIONS

Revenue from sales approximated only $2,600; as against $8,736 in 1966–67, $8,000 in 1965–66 and $12,000 in 1964–65. The explanation is that all major textbooks ("Weeds", "Pastures", "Trees of N.S.W.") are out-of-stock whilst 2nd Editions are being produced.

Some observations on specific sale items are of interest:

"Jam Making" (15 cents) has provided only 13 sales in 1967–68; and of the 600 copies drawn from the printery on 29th September, 1966, there are still 131 in stock. Most of the 469 sales were during a concentrated push at the 1967 R.A.S. Show.

"Home Lawn" (20 cents) is in better demand; 523 copies sold in 1967–68.

"A Guide to Pest Destroyers" ($2.50) became available on 12th February, 1968, and has yet to prove itself as a sale item. So far, 42 copies have been sold.

"Dairy Farm Buildings" (75 cents) became available on 19th July, 1967, and is a slow seller; 269 sales so far.

The *new-system Farm Record Book* yielded $904 in the total of $2,600 from sales publications. Demand for this item has been disappointing but is expected to improve as familiarity with it diffuses in the rural communities.

Pastures book sales yielded $802 of the $2,600 total but this was only remnant stock. The book is now out-of-stock pending a 2nd edition.

HOME GARDENS ADVISORY SERVICE

Individual Contacts.—The Home Gardens Advisory Officer (H.G.A.O.) dealt with 5,708 home garden, allied and commercial floricultural inquiries of a type that office assistants in the Inquiry Counter Section would be unable to service by using the literature range.

In 1966–67 his total was 6,866, in 1965–66 (a drought year) it was 5,881 and in 1964–65 it was 6,352. The relatively low total of 5,708 this year reflected in part the changed address, in part the postal strikes, and in part the continuation of dry conditions.

In the 5,708 inquiries were 3,016 telephoned, 1,131 postal and 1,481 in-person contacts; plus 80 inquiries from field officers—compared with 31 in 1966–67.

The telephoned requests would have been much higher than has been recorded, provided inquirers could get through to the adviser before becoming impatient or provided they were willing to try again after experiencing the delays. This is not a reflection on the telephone-exchange. It reflects need of a second adviser, as has been supported by a Public Service Board O. & M. team's analyses during 1967.

Mass and Group Media.—The Gardens Adviser made a six-minutes tape recording for use in the A.B.C. Childrens Hour, in response to inquiries by children; contributed to most issues of the weekly broadsheet *Press Copy* before this was discontinued in October, 1967; revised the publication "The Dahlia", completed a roneo publication "Christmas Bells", and wrote an article "Sweet Pea Culture".

He provided also four lectures (evening): to a Roseville group on "Common Garden Pests", to a Royal Horticultural Society group on "The Waratah", to a Nepean Horticultural Society group on "Plant Propagation", to a West Pymble Garden Club on "Garden Shrubs", and two lectures (day): to Mosman Rotary Club on "Common Garden Pests", to a Blue Mountains Gardens and Beautification Group on "Common Garden Pests". He has visited also the Kuring-gai Municipal Council's Native Plants Reserve at St Ives and various plant nurseries near Sydney.

LIBRARY SERVICES

Major Staff Change

Mr J. Hazell, Librarian-in-Charge of the Department of Agriculture Library services for the past 8 years, and O.I.C. of the combined Library (six Departments) in the State Office Block since inception, left the service in May, 1968, to accept a senior post in the University of N.S.W. Library. His successor in charge of the combined State Office Block Library is Miss M. Siebert, seconded by the N.S.W. Public Librarian.

General

Central Library, State Office Block.—The Library in its new circumstances, in the State Office Block, now services six Government Departments (Agriculture, Public Works, Local Government, Premier's, Treasury, and Mines).

Efforts have been made throughout this year to develop common policies, particularly in respect of periodicals' circulation and purchase of books. Amongst other things, an Order Form which can be used for orders on behalf of all Departments has been introduced and has increased efficiency.

More space has been acquired, through transfer of the Document Reproduction Centre to another floor. This space has now been established as an area for receipt and despatch of library mail, and the accessioning and circulation of periodicals. Earlier, this phase of library activities was in difficulties because of insufficient working space.

Access to the teleprinter in Premier's Department has enabled the library to seek urgent information from the Agent-General in London. The teleprinter has also been used for inter-library lending requests.

Branch Libraries.—The Librarian-in-Charge inspected library facilities in the Branch Libraries at the Wagga Agricultural College and the Agricultural Research Institute, Wagga. Each of these is in new accommodation. The libraries at the Veterinary Research Station, Glenfield, and the Division of Science Services, Rydalmere, also were inspected.

The Library of the Geological Survey of N.S.W. was transferred to new accommodation, and considerable development in this collection seems likely as well as additional demands on the State Office Block library.

Library advice was given also to the Hydraulics and Soils Laboratory of the Public Works Department, Manly Vale, and further development at this centre is likely.

The National Parks and Wild Life Service and the Fisheries Branch of the Chief Secretary's Department were also given professional library advice.

The Librarian-in-Charge and all Branch Librarians attended a Seminar on Government Department Libraries in October, 1967. This seminar organized by the Principal Librarian, Public Library of N.S.W., should have far reaching effects in the organization and management of Government Libraries.

Funds for Books, Periodicals, Papers

Only the Agriculture Department's C.R. B4 Vote increased significantly. The increase was from $12,000 to $14,400. The Librarian-in-Charge has commented that increases should be made in the library funds of all other Departments in the State Office Block Library, especially so for Mines and Public Works.

Through Agriculture, the Library had access to $15,500 from the Commonwealth Extension Services Grant. This enabled big increases in purchase of reference material for country extension and research personnel in the Department of Agriculture and in placement of periodical subscriptions on their behalf.

For the Hawkesbury, Wagga, and Yanco Agricultural Colleges, good use was made of the respective College Trust Account for book purchases.

Orders, Accessions, Loans

Orders Placed for Department of Agriculture.—2,549 items were ordered or covered by requisitions, through local booksellers and other sources, or through the New South Wales Government Offices in London. Of these: some 1,568 items were ordered against the Commonwealth Extension Services Grant Project 510; 473 against the C.R. funds B4 Item: "Books"; 95 against the Hawkesbury Agricultural College Sundry Trust Account; 297 against the Wagga Agricultural College Sundry Trust Account; and 116 against the Yanco Agricultural College Sundry Trust Account.

Central Library Accessions.—31,841 items were accessioned, as against 16,476 in the 12 months of 1966–67. The 31,841 included: 1,328 books, 24,085 new issues of periodicals, 1,470 annuals, and 4,712 pamphlets. The 4,712 pamphlets comprised 3,713 for series, 589 for cataloguing and 452 for distribution by subject. The rate of items accessioned averaged 612 per week.

Central Library Loans.—A break-down of the loans total, per Department is not available. Loans totalled 45,704, as against 27,178 in the 12 months of 1966–67. The 45,704 comprised: 35,559 periodical issues circulated (average: 684 per week) and 10,145 miscellaneous items (average: 195 per week). In the 10,145 miscellaneous items: there were 8,712 loans to Departmental officers, and 1,041 to Libraries of other institutions. Borrowings from other Libraries totalled 392.

Branch Libraries' Loans.—Collated statistics are not available at this time but the loans from Branch libraries have been considerable.

New Exchanges Arranged

Exchanges were arranged for agriculture literature from India, Italy, Japan, New Zealand, The Philippines, Republic of South Africa, and Rumania, reciprocal for the *Agricultural Gazette of N.S.W.* or for the *Review of Marketing and Agricultural Economics.*

Other Library Services

Library Bulletin.—Twelve Bulletins were compiled and distributed. These totalled 505 pages and 5,268 items, as against 379 pages and 4,262 items in 1966–67. Effort has been made to be increasingly critical in selecting items for the Bulletin, as this publication is now taking on size-difficulties.

Reference Work and Literature Searches.—Bibliographies produced through literature-searches done for Departmental officers were regularly listed in the Library Bulletin for their possible value to other workers.

Seventy-one searches were listed as against 85 in 1966–67. The lower figure is due to the reference staff being able to give better direct service, and to more readers using material within the library premises.

Photocopying Service.—The jobs done for the Library by the Document Reproduction Centre totalled 947 and involved 7,639 sheets; as against 609 jobs involving 5,720 sheets in 1966–67.

DIVISION OF EXTENSION SERVICES

New Division, Effective from January, 1968

In December, 1967, the Public Service Board approved of the establishment of a new Division within the Department of Agriculture—the Division of Extension Services. The Division became effective in January, 1968, through amalgamation of the Regional Extension Services unit with sections transferred from the Division of information Services, viz. the Agricultural Bureau of N.S.W. and allied Group Extension, the Women's Extension Service, and the Audio/Visual Aids Section.

Mr J. L. Green, Chief of Regional Extension Services since inception of that administrative unit, retired in August, 1967. His immediate assistant Mr B. D. Ament, Principal Extension Officer (Regional Services) succeeded as Acting Chief of Regional Extension Services.

Mr Ament was appointed Chief of Division of Extension Services on inauguration of the new Division. Mr J. J. Slater, Special Extension Officer (Agricultural Bureau and Group Work) became the successful applicant for the Principal Extension Officer position in the new Division. Mr M. J. R. MacKellar, Extension Officer (Agricultural Bureau) became the successful applicant for the Special Extension Officer position vacated by Mr Slater, but with change of designation to Assistant Principal Extension Officer (Group Extension).

Functions of the New Division

The functions of the new Division *inter alia* are to—

- administer and co-ordinate the Department's extension services through the nine Agricultural Regions;
- review, report, and recommend to the Director-General on matters relating to the operation, improvement, stimulation, organization, and co-ordinataion of the Department's extension sesrvices;
- administer Commonwealth Extension Services Grant Funds, including preparation of expenditure submissions and estimates;
- arrange meetings of and act in an executive capacity for the nine Regional Advisory Committees;
- supervize, develop, and maintain the offices in Regions;
- liaise with Chiefs of Divisions and Heads of Branches in promotion of extension programmes flowing from research findings, and in the co-ordination of Divisions' technical and extension programmes;
- develop the skills of extension workers in use of extension channels, methods, and equipment;
- organize and conduct schools to improve extension workers' communicative ability, knowledge and understanding of the extension process, attitude towards extension, and overall extension abilities;
- develop extension programming, and extension officers' abilities to formulate and execute work plans;
- encourage and assist extension workers to measure and evaluate the effectiveness of their extension efforts and to compare the effectiveness of various methods in accordance with extension purpose;
- provide organizational help to the Agricultural Bureau and promote group extension activities through this and other rural groups, including extension services for rural women;
- assess and acquire audio visual aids equipment for extension workers and develop extension workers' skills in using aids, including radio and television.

The Status of Extension

FRESH IMPETUS

Agricultural extension gained fresh impetus from events and developments during the past 12 months. Principal among these were: a Departmental "Extension Policy and Design Workshop" at Terrigal in September, 1967; subsequent formation of an "Extension Policy Committee" and an "Extension Programme Co-ordination Committee", as standing committees; establishment of a Division of Extension Services; adoption of extension programming and work-planning, as a requirement of all extension workers.

The Extension Policy and Design Workshop

This was a 4-day workshop to examine the extension policy of the Department, the design and structure of the extension service, and the extension methods used by personnel.

From this examination, some adjustments to the service were draftetd for consideration at other levels, towards meeting current and future needs. Following this workshop, two important Departmental standing committees were constituted, viz., the Extension Policy Committee and the Extension Programme Co-ordination Committee.

The Extension Policy Committee

This comprises all Chiefs of Divisions, under the Chairmanship of the Deputy Director-General (P.T.). The committee is to advise and assist the Director-General in relation to extension policies, objectives and procedures.

ESTABLISHED POSITIONS IN THE DIVISION OF EXTENSION SERVICES

	Head Office	Mid Coast and Hunter	Mid Western	Northern	North Coast	North Western	South Coast and Table-lands	South-ern	South Western	Western	Not in Regions	Total
Head Office:												
Chief	1	..	..	..	..	..	..	..	..	..	..	1
Principal Extension Officer	1	..	..	..	..	..	..	..	..	..	..	1
Assistant Principal Extension Officer (Group Extension)	1	..	..	..	..	..	..	..	..	..	..	1
Extension Officer (Short Term Schools/Courses)	1	..	..	..	..	..	..	..	..	..	..	1
Extension Officers (Agric. Bureau)	3*	..	..	..	..	..	..	..	..	..	..	3
Extension Officer (Photo. and Allied Aids)	1	..	..	..	..	..	..	..	..	..	..	1
Extension Officer (Radio)	1	..	..	..	..	..	..	..	..	..	..	1
Extension Officers (Display Artists/Designers)	2	..	..	..	..	..	..	..	..	..	..	2
Extension Officers (Women's Service)	3*	..	..	..	..	..	..	..	..	..	..	3
Technical Assistants	2	..	..	..	..	..	..	..	..	..	..	2
Rural Offices:												
Regional Supervisors	..	1	1	1	1	1	1	1	1	1	1	9
Regional Publicity Officers	..	1	1	1	1	1	1	1	1	1	1	9
Field Assistants	..	4	2	3	4*	2	6	2	8	4	2	37
Italian Liaison Officer	..	..	..	..	..	..	..	..	1	..	..	1
Information Officer	..	..	..	..	..	..	..	1	..	..	..	1
Clerical (Head Office and Rural):												
Clerks	3	1	..	1	1	..	1	1	1	1	..	10
Clerk (supernumary)	1	..	..	..	..	..	..	..	..	..	..	1
Shorthandwriter/typists	3	5	2	5	10*	1*	3	6	3*	6*	3	47
Office Assistants	3	2	8*	1	7	4	6*	4	8*	5	2	50
Total establishments as at 30th June, 1968												181

* Positions were vacant at 30th June, 1968, for: one Extension Officer (Agricultural Bureau) and two Extension Officers (Women's Service) at head office; for one field assistant in North Coast Region; four shorthandwriter/typistes in Regions (respectively one each in North Coast, North Western, South Western, and Western Regions) and three office assistants in Regions (respectively one each in Mid Western, South Coast and Tablelands, and South Western Region).

The Extension Programme Co-ordination Committee

This comprises the Principal Extension Officer from each Division, under the Chairmanship of the Chief of Division of Extension Services. The committee is to advise the Director-General through the Extension Policy Committee, on extension programming and the implementation of programmes/work plans.

Extension Programming

To give more purpose and design to the Department's extension activities all extension officers were required to submit planned extension programmes for 1968–69. These programmes are an expansion of the "Targets for Achievement" required of extension officers by the Director-General in the preceding year. Through "situation analysis" extension objectives are formulated, long- and short-term. The situation analyses are required to take into account: physical and technological factors affecting productivity, efficiency and farmer attitude; socio-economic factors in the area concerned; the extension service resources, external help needed, and a realistic appreciation of the pressure of non-extension activities.

When approved objectives have been established, extension officers are required to draw up work plans for a 12 months period, detailing how it is proposed to achieve the objectives. At the end of each 12 months the programme is to be reviewed, revised and redirected if necessary, to meet changes in the situation.

Regional Supervisors have been given the responsibility to implement extension programmes approved by the Chiefs and Principal Extension Officers of the various Divisions and Branches.

An important aspect of extension programming is that the situation analysis completed each year will provide a "bench mark" for subsequent measurement and evaluation of progress.

The Extension Policy Committee has recommended that representatives of farmer organizations be consulted when programme objectives are being considered. Among these would be committees of management of branches of the Agricultural Bureau and each Region's "Advisory Committee to the Minister".

Advantages of this procedure are that: representatives have opportunity to express ideas about extension objectives, and provide a "sounding board" for the programme objectives thought by extension officers to be desirable; *and*, by being consulted in the first instance about items for the extension programme, organizations will be part-owners of the programme and more likely to add their weight to the efforts of the extension service.

The Extension Policy Committee has also recommended, within programmed objectives, the inclusion of schools/courses for farmers in such basic science subjects as soils, botany, animal physiology and nutrition, and farm management economics. The Committee's view is that this type of school or course develops farmer receptivity to new ideas and skills needed in adjusting to changing circumstances.

Extension Service/Methods Training Schools and Examinations

SCHOOLS/COURSES

The Division had the responsibility for the first time of conducting the annual in-service Extension Service/Methods School. This was held at Hawkesbury Agricultural College, over 10 days, and was attended by 41 officers. The attendance included three District Supervisors of the Rural Youth Organization, two private Farm Management Consultants, and two officers from private enterprise.

This Division also provided on various occasions sessions on extension principles and methods at other short schools for officers of Divisions and Branches.

The Public Service Regulation 124 Higher Grades examination on Agricultural Extension for Departmental field officers and Rural Youth Organization officers was set and will be marked by the Assistant Principal Extension Officer (Group Extension).

Two officers of the Division by invitation from the Chief of Division of Information Services assisted as tutors during a one-week school on Extension Principles/Methods for second year undergraduates in Agriculture, University of Sydney.

In-Service Development of Field Officers

In-service development of officers of the production Division before entry to full-time extension work continued in all Regions. The Department's policy requires a potential field extension officer to undergo a 2-year period of development at one or more of the Agricultural Research Stations. Then follows a term of from 6 to 12 months' intensive development in one or more of the nine Regions before the officer is appointed to a District as the extension worker in his discipline.

In the Region, under the guidance of the respective Regional Supervisor, the officer is placed with experienced extension personnel for development training in all aspects of extension work and administrative procedures.

Voluntary Development of Officers

Three officers in the Division of Extension Services establishment are part-time students, voluntary, for the B.A. degree, whilst others in the Division have undertaken specialized forms of training, or are pursuing study courses to increase their efficiency and/or fit them for higher positions.

The Agricultural Bureau and Allied Group Work

GENERAL

The Agricultural Bureau Branches.—At 31st May, 1968, there were 124 branches affiliated with the Advisory Council of the Agricultural Bureau of N.S.W., compared with 113 a year earlier. The total of members for whom an affiliation fee was paid to 31st May, 1968, was 5,791; an increase of 1,501 over the previous year.

Four new branches were formed—Grenfell, Nambucca and District, Mid Bogan, and Coff's Harbour and District. Also Rocky Glen Branch was re-formed.

The small branches at Derriwong-Ootha and Grawlin Plains formally ceased in October, 1967. Their members have been absorved by the Condobolin and the Forbes Branch respectively.

43rd State Congress.—The Hon. Edward Clark, United States Ambassador to Australia, officially opened the 43rd Annual State Congress of the Bureau in 1967. The Congress was at Hawkesbury Agricultural College from 29th August to 1st September.

The programme comprised mainly technical/educational topics and in general was up to standard whilst some sessions were outstanding. A subsequent assessment, however, was that the attendance figures were not in keeping with the effort and expense of organizing the event. This has been the trend in recent times and has led to a decision recorded in the following note.

State Advisory Council Activities.—Nine of the 10 Agricultural Bureau regions were represented in the State Advisory Council. Northern Region was the exception.

The Council held four meetings and attendances averaged 17 councillors.

Changes from the traditional Annual State Congress were amongst the matters determined. The following decisions were made:

> That the 1968 programmes be slanted towards policy and administrative matters of the Bureau; balanced by providing special speakers on select topics for the evening sessions;
>
> That the day programme comprise discussions/panel sessions requiring delegate participation;
>
> That the event be held in conference conditions at Terrigal.

Advisory Council meetings devoted time also to discussion of the role of Advisory Councillors. The emphasis was that Councillors must be active in the respective area, in promoting and overseeing Bureau activities at branch and Regional levels. To help achieve this Councillors are to receive a type of training possible at each Council meeting.

Affiliation with other Organizations.—The Agricultural Bureau is affiliated with the following organization: National Farmers Union (N.S.W. Chamber); Rural Youth Movement; Water Research Foundation; Australian Association of Adult Education; Post-Graduate Foundation of Veterinary Science; Bush Nursing Association of N.S.W.; and the Associated Country Women of the World.

Decentralized Conventions/Field Days.—Six conventions/field days of annual character were held on a Regional/Divisional basis. These were: Clarence Division Field Day at Macksville (400 attended); Cumberland-Central Coast at Wyong (62); Mid-Coast and Hunter Region at Tocal (90); Mid Western Region at West Wyalong (200); Richmond-Tweed Division Machinery Field Day at Casino (2,000); and South Coast and Monaro Division at Berridale (60).

BEEF CATTLE BREEDERS' COMPETITION 1967–68

The Rural Bank of N.S.W. and the Department again co-operated with the Agricultural Bureau of N.S.W. to conduct this competiiton. There were 104 entries this year, as against 126 in the previous competiiton. The State winner was the entry by S. and M. Fox of "Kurrajong Park", Coolah.

Over 1,000 people attended field days held in association with the District and State judgings.

SCHOOLS AND COURSES

The Agricultural Bureau Schools/Courses

Through its Branches and Regional Councils the Agricultural Bureau conducted 95 schools and courses for farmers; compared with 77 iu 1966–67, 58 in 1965–66 and 29 in 1964–65. Schools organized as part of a co-ordinated series seemed the more successful. As well, Agricultural Bureau branches sponsored 23 of the homemaker schools conducted by the Women's Extension Service.

The distribution of schools/topics follows, with attendance figures in parentheses.

Sheep Enterprise Schools/Courses

Clip Presentation and Wool Marketing: Two—Tamworth (60), West Wyalong (35); *Drenches and Drenching*: One—Goulburn (75); *Prime Lamb Production on Winter Pastures*: One—Walgett (25); *Raising Healthy Lambs*: Five—Bathurst, (85), Mt Victoria (17), Mudgee (45), Orange (60), Wellington (45); *Sheep Reproduction*: Four—Coleambally (46), Condobolin (46), Cowra (60), Forbes (80); *Sheep and Wool Improvement*: One—Goulburn (40).

Beef Enterprise Schools/Courses

Beef Cattle: Five—Bingara (60), Cowra (60), Legume (not recorded), Macksville (50), Inverell (80); *Beef Marketing*: One—Goulburn (67); *Beef Cattle Diseases*: Two—Adelong (184), Jingellic (150).

Schools/Courses on Pasture/Fodder Enterprises

Drought Feeding: Eight—Bombala (20), Boorowa (21), Coilingullie (20), Condobolin (20), Cootamundra (34), Crookwell (60), Grenfell (90), Young (35); *Fodder Crops and Fodder Conservation*: Three—Boorowa (not recorded), West Wyalong (48), Wyong (course) (40); *Pasture Establishment and Management*: Three—Bombala (70), Coleambally (90), Cooma (24); *Pasture Utilization*: One—Merriwa (60): *Silage*: One—Wauchope (70).

Schools/Courses on Cropping Enterprises

Advanced Fertilizers: One—Bathurst (30, the limit); *Banana Marketing*: One—Coff's Harbour (42); *Cereal Fertilizers*: One—Cootamundra (85); *Crop Production*: One—Legume (not recorded); *Insect Pest Control in Orchards*: One—Young (12); *Lucerne Production*: Two—Dunedoo (48), Merriwa (50); *Oil Crop and Summer Grain Crops*: One—Narrabri (52); *Orchards (Stone Fruit)*: One—Camden (250); *Summer Crops and Fertilizers*: One—Coonabarabran (33); *Vegetable Diseases*: One—Maitland (60); *Vegetable Production*: One—Kingscliff (60); *Wheat Nutrition*: Four—Boorowa (33), Forbes (44), Narrabri (56), Parkes (18); *Wheat Production*: Seven—Ariah Park (96), Bathurst (47), Mudgee (22), Narromine (50), Tottenham (90), Walgett (62), Wellington (35); *Winter Cereal*: One—Dunedoo (33).

Water Supply Schools/Courses

Farm Water Supplies: One—Boorowa (33); *Irrigation*: One—Condobolin (42).

Agricultural Engineering Schools/Courses

Farm Machinery: Two—Macksville (500); Young (37); *Tractor Maintenance*: Five—Dubbo (20), Eurimbla (15), Fairy Hill (25), Millthorpe (25), Wongarbon (15); *Welding*, Three—Ariah Park (14), Cootamundra (15), Nangus (14).

Farm Economics Schools/Courses

Farm Management: One—Dunedoo (30); *Income Tax and Estate Planning for the Man on the Land*: One—Coonabarabran (20), *Investment on the Stock Exchange*: One—Cowra (60, the limit); *Land Valuation*: Seven—Bathurst (30), Blayney (30), Dubbo (90), Mudgee (85), Mullion Creek (35), Running Stream (30), Wellington (60); *Technical and Fnancial Symposium*: One—Baradine (37).

Schools on Miscellaneous Topics

Advanced Dairying: One—Muswellbrook (127); *Graziers*: One—Tuena (50); *Lapidary*: One—Cowra (65); *Pig Production*: Three—Cowra (44), Trundle (40), Young (35); *Public Speaking and Meeting Procedure*: Two—Glenbrook (32), Tottenham (32); *Stock Parasites Forum*: One—Cowra (30); *Yass Valley Project Course*: One—Boorowa (25).

Where possible, booklets/notes were prepared and distributed to students attending the schools.

Department of Agriculture officers are still the more frequent lecturers at Bureau schools, courses and meetings. However, speakers from industry and commerce and, in particular, farm management consultants are appearing frequently. Speakers from State and Commonwealth Government Departments and from Universities, intra- and inter-State, also addressed Bureau functions.

Schools/Courses Resulting from Allied Group Work

Besides the Group activities conducted for or by the Agricultural Bureau and Women's Services, the Department was a major factor in 75 other schools for farmers; either in the respective rural area or at one of the Agricultural Colleges during vacations. Their distribution and topics follow, with attendance figures in parentheses.

Livestock Management Schools/Courses

Beef Cattle: Three—Casino (80), Hawkesbury Agricultural College (20), Yass (50); *Friesian Cattle Judging*: One—Hawkesbury Agricultural College (50); *Horse Mustering*: One—Hawkesbury Agricultural College (20); *Pig Raising*: Three—Gilgandra (65), Hawkesbury Agricultural College (44), Hillston (35); *Poultry*: Two—Hawkesbury Agricultural College (40), Wagga Agricultural College (not recorded); *Sheep*: Two—Hay (not recorded), Wagga Agricultural College (not recorded); *Drought Feeding*: 30—Adelong (50), Albury (25), Bega (50), Bookham (30), Braidwood (45), Cooma (100), Deniliquin (60), three in Finley area (81), Goulburn (50), Grenfell (90), Griffith (20), Gundagai (120), Hay (45), Holbrook (30), Humula (15), Junee (90), Lady-Smith (30), Leeton (7), Queanbeyan (106), Rand (12), Savernake (15), Tarcutta (42), Tumbarumba (23), Tumut (80), Tumut (dairying) (20), Wakool (43), Walbundrie (38), Yass (120).

Crop and Pasture Management Schools/Courses

Irrigation: Three—Deniliquin (250), Moulamein (20), Oaklands (200); *Summer Crops*: One—Berrigan (130); *Weeds*: Three—Leeton (44), Queanbeyan (40), Tamworth (not recorded); *Wheat*: Six—Barellan (60), Collarenebri (not recorded), Mungindi (not recorded), Tullibigeal (16), Wagga (90), Yass (40).

Fruit Growing Enterprises Schools/Courses

Fruit Packing: Three—three in Southern Region (30); *Fruit Storage*: One—Batlow (25); *Fruit Tree Pruning*: Two—Wamoon (32), Yanco (20).

Farm Economics Schools/Courses

Farm Management: Three—Berry (180), Gunnedah (not recorded), Wagga Agricultural College (not recorded); *Wool Marketing*: One—Culcairn (65).

Agricultural Engineering Schools/Courses

Agricultural Machinery: One—Deniliquin (60); *Tractor Maintenance*: Six—three in Southern Region (105), Murwillumbah (not recorded), Wardell (not recorded), Yanco (not recorded); *Welding*: One—Ganmain (9).

Other Schools/Courses

Graziers Schools: Two—Goulburn (35), Hillston (65); *"Future of Primary Production" Conference*: One—Walcha (120).

Other schools/courses/conferences organised and/or conducted by officers of the Department included in-service training schools and conferences and special schools for industry operatives, to which there are references in the reports of the various Divisions/Branches.

Women's Extension Service

LOSS OF STAFF

Senior Extension Officer Miss N. M. Foskett, Officer-in-Charge of the Women's Extension Service since 1947, retired in October, 1967. Another Extension Officer (Women's Service) resigned in June, 1968. The positions have remained vacant.

WOMEN'S SCHOOLS/COURSES

The Women's Extension Service this year organised 43 one day schools compared with 57 last year. Twenty-five of the 43 schools were tutored by staff members and 18 by external tutors. Twenty-three schools were conducted for Agricultural Bureau Branches and 20 for other organizations mainly Country Women's Association Branches. The distribution of schools/topics follows, with attendance figures in parentheses.

Basic Floristry: Two—Blayney (64), Condobolin (63); *Dressmaking*: Three—Cobar (23), Millthorpe (21), Trundle (21); *Flower Arrangements*: Four—Baradine (45), Cowra (56), Dooralong (35), Purlewaugh (45); *Food Presentation*: Seven—Bingara (41), Blayney (38), Cooma (92), Inverell (40), Mila (38), Tenterfield (59), Wyalong (48); *Gardening and Garden Planning*: One—Cowra (91); *Home Colour Schemes*: One—Jingellic (13); *Home Furnishing and Decoration*: Two—Toronto (61), Tottenham (19); *Millinery*: Seven—Condobolin (28), Inverell (45), Lake Cargelligo (38), Moss Vale (20); Trundle (43), Warialda (28), West Wyalong (28); *Personality with Poise*: Eight—Coleambally (22), Delegate (22), Gosford (70), Gundagai (15), Jerilderie (38), Nyngan (33), Trangie (27), Wellington (31); *Planned Work More Leisure*: Two—Bourke (18), Mila (17); *Skin and Beauty Care*: Two—Bowraville (27), Coff's Harbour (36); *Understandng Ourselves*: One—Carrol (36); *Voice, Speech and Personality*: Two—Bowral (50), Singleton (80); *Wardrobe Plannng*. One—Forbes (not recorded).

PUBLICITY ACTIVITIES

Sixty-three publicity statements were prepared, largely concerning the organization of schools, as were 42 tape recordings released through Regional channels.

Ten articles and 14 "fillers" were contributed to the Farm Home pages of the *Agricultural Gazette of N.S.W.* Script for a television session on "Ti-tree Bark Picture Craft" was prepared for use by South Coast and Tablelands Region.

Audio Visual Aids Section

FILM AND PHOTOGRAPHIC

Cine Film Production.—Producton of the film "A Dairy Farm Returns to Profit", on the Rapid Development Whole Farm Feed Year Study at Uki, was completed by the Audio Visual Aids Section. The film was well received at a premiere screening in the State Office Block Theatrette. The radio and photographic aids officers recorded the soundtrack, with the radio officer as commentator.

The Section also helped the Commonwealth Department of Primary Industry and Department of Interior Film Unit in making the film "Dealing with Drought". This film has been widely used in the Southern, South Western and South Coast Tablelands Regions during the drought.

Two film clips for rural TV programmes were filmed. One dealt with the Computer processing of data on fruit research. The other dealt with the effectiveness of machinery for citrus-spraying.

Cine Film Library.—Two hundred and six programmes comprising 413 films were collated and loaned to country offices. This compares with 203 programmes in 1966–67.

Field Officers' 35 mm Photography.—A total of 18,546 photographs by field officers, compared with 20,645 in the preceding year, passed through the Photographic Aids Section for attention and return to the field as 35 mm slides for extension use. In the total were 12,400 colour and 6,146 black and white diapositives. All processing and mounting of the black and white photography was effected in the Department's laboratory.

Special Purpose Photography.—The Photographic Aids Section this year made 2,079 prints and enlargements. Some 392 of the prints were enlargements to greater than 12 in x 10 in. This was a substantial increase compared to the previous year and was because of the demand by Regional officers for larger prints for television uses.

Ninety-one special photographic assignments were undertaken. These included three visits to Seven Hills Poultry Research Station, a visit to Glenfield Veterinary Research Station, the White Bay Grain Elevators Terminal, and the Royal Botanic Gardens.

Duplicate colour slides arranged from extension officers' originals totalled 139, and 141 copies and negatives were prepared from colour slides and prints.

Negative Loans from Photographic Library.—204 negatives were loaned for block-making in publications. Most were to the Publications Section of Division of Information Services. Other borrowing organizations included Department of Conservation, the Commonwealth News and Information Bureau, the Men of the Land Society, the Rural Bank of N.S.W., and rural newspapers.

DISPLAY/DESIGNING

The two major exhibits designed and staged were the "Exotic Animal Diseases" exhibit at the Sydney Royal Show and, during Apprenticeship Week, a Careers Exhibit in the Government section of displays at the Sydney Town Hall.

A smaller, portable version of the "Exotic Animal Diseases" exhibit was planned, for use in many localities, inter- and intra-State, and construction of the display has started.

Display work by way of signs and illustrations was prepared for the Orange National Field Days, a poultry exhibit at Hawkesbury College, and the Bega, Camden and Tamworth Shows. Ninety-four jobs involving illustrative/design, lettering and finished art work were undertaken.

FARM RADIO

Extent.—Regional publicity officers' reports continue to show a high use of radio in extension. In excess of 5,000 broadcasts were made through country stations, national and commercial. Only three of the 45 rural radio outlets do not use material provided by the Department and their reason is that they consider their audience to be too urban in character.

Tape Recordings.—The five country radio stations comprising a "Mid-State Network" started a "Champion Wheat Farmer of the Year" competition. This involved five x five minute sessions, Monday to Friday inclusive, on each station, and was an excellent medium for extension aimed at a special audience. The series ran for 14 weeks. Three interview talks were recorded with head office and Science Services specialists for inclusion in the series and the other two sessions were provided from Regional sources.

Several interviews were recorded with the Chairman of the Grain Elevators Board.

Fifty-three publicity tapes for Women's Service schools/courses were prepared, and ABC and 2GB interviews of the schools' lecturers were also arranged.

For the 22 officers of the Taxation Department's Advisory Tour System, radio scripts were written, and interviews were recorded with each team of two before their tour of country centres. The interviews were replicated and distributed regionally for broadcast.

Thirty-eight interviews/talks were recorded with specialist officers at head office and Rydalmere. Most of these recordings were released regionally but some were specially broadcast in the ABC Country Hour.

For the Department of Child Welfare the musical soundtrack for a film on "Treatment of Delinquent Children" was recorded, using the section's special equipment.

DISTRIBUTION OF AUDIO/VISUAL AIDS EQUIPMENT

The following equipment acquired from the Commonwealth Extension Services Grant Funds was distributed to country offices: 44 Public Address systems, 45 overhead projectors, 54 x 35 mm semi-automatic slide projectors; nine camera flashguns (one per Region).

Further items on hand or on order and to be delivered early in 1968–69 are: 28 miniature transistorized tape recorders, 45 ft x 6 ft square screens for overhead projector occasions, 90 screen stands and nine dry-copy transparency machines (one per Region).

Regional Services

STAFF IN THE REGIONS

At 30th June, 1968, some 432 of the officers in country districts were under Regional administration for advisory, regulatory, and allied services to primary producers. In this total were 88 officers in clerical/office assistance categories. (Personnel at Research Stations and Agricultural Colleges and the veterinary personnel are not within the Regional Supervisor system.)

There are a further 50 positions vacant within Regions. Thus the total of positions in the Regional system is 482; 14 more than a year earlier.

Office Accommodation

Improvements in office accommodation continued. Most Regional headquarters and District offices have reached quite a good standard. An exception is the Regional office at Gunnedah where accommodation is inadequate and further appointments would aggravate the situation. It is especially inappropriate accommodation for the headquarters of a Region.

New offices have been established this year at Condobolin, Hay, and Warren. More modern accommodation has been provided at Coonabarabran, in the Pastures Protection Board offices; also at Narrabri, in the newly erected Government Office Building, and at Queanbeyan where a new suite was rented in December, 1967.

Batlow office has been closed and the staff transferred to Tumut, to new premises rented in November, 1967. Tumut office is now a modern and compact administrative centre.

At Wagga, the construction of two additional floors over the existing Government offices, and a floor of offices over the garages, has been completed. Air conditioning, an automatic telephone system and a lift have also been installed. The Regional Supervisor, Southern, has been appointed Officer-in-Charge of the new Government Office Building at Wagga. Eight Government Departments are now located in this building.

REGIONAL ADVISORY COMMITTEES

The nine Advisory Committees appointed by the Minister and representative of primary industries and areas within the respective Region continued their important role in offering recommendations to promote and improve extension and research. The Minister attended some meetings to confer in person with members.

EXTENSION AND PUBLIC RELATIONS

Good public relations were maintained with both the urban and rural members of the community. Press, radio, and television continued to be well utilized in the Regions. The co-operation from managements of these services has been excellent. Use of mass media and such group activities as schools, courses, and field days further enhanced the image of the extension service and the Department of Agriculture as a whole. The following table summarizes an account of group and mass media usage within the Regions.

MASS AND GROUP MEDIA USAGE—REGIONAL STATISTICS

Region	Publicity Statements	Newspaper Supplements	Radio Contributions	Television Sessions	Schools/ Courses Conducted	Field Days Conducted
Mid Coast and Hunter	362	1 (major)	350	..	19	21
Mid Western	219	6	821	20	41	34
Northern	165	2	475	13	13	22
North Coast	405	3	895	38	3	78
North Western	130	1 (major)	1,012	10	21	12
South Coast and Tablelands	250	..	415	25	25	21
Southern	273	..	372	17	36	20
South Western	99*	3	?	52	22	23
Western	209	1 (major)	1,284	60	26	15
Totals	2,013	17	5,624 (South West)	235	206	246

* For much of the year the South Western Region was without the services of a Publicity Officer.

SOME HIGHLIGHTS FROM REPORTS BY REGIONAL SUPERVISORS

Mid Coast and Hunter Region

Tenth Anniversary of Region.—A special newspaper supplement was prepared to mark this occasion.

Other Special Publicity.—Special publicity was provided also for other particular events. These included locust control, bush fire week, blood-testing of vegetable growers for insecticide residue, and establishment of a Mid and Upper Hunter Agricultural Research Council.

Farm Management Services.—The trend in farm management services in the Region is continuing. Group Farm Management Schemes are now operating from Smithtown, Taree, and Hexham; all in association with a leading fertilizer company.

There are now three Farm Management Consulting Services in the Region, at Kempsey, Scone, and Taree, and opening of a further service is likely at Dungog. Close liaison with the consultants is maintained by Departmental officers.

Without the services of an economics research officer, this Region's offices are at some disadvantage. The position established in 1963 has not been filled.

Drought and Flood Relief.—Notably, this Region was able to contribute a lot to alleviation of drought in other areas of the State soon after suffering its own worst drought on record. Following June floods on the north coast, an appeal for gift hay was launched in the Hunter Valley and resulted in despatch of more than 7,000 bales.

Later in the year the dairy companies and local government bodies arranged drought relief measures in the form of gift hay and some free agistment. Dungog community repaid also some of the Victorian farmers' generosity under "Operation Goodwill", by arranging free agistment for 1,400 head of Victorian drought-affected stock. About 9,000 head of stock were agisted in Upper Hunter areas.

Mid Western Region

New Agronomist District, Condobolin.—With major development of irrigation along the Lachlan and agriculture increasing in Western Division the establishment and filling of a new District agronomist position, based on Condobolin, has been a highlight. This provides a more complete agricultural extension service for Lachlan Shire, and service also for adjacent areas of the Western Division.

Research/Extension Liaison.—Pasture Research/Extension Conferences were conducted at Condobolin and Cowra, involving the extension officers in each locality and research personnel of the Agricultural Research Stations.

The Central West Wheat Nutrition Research Programme continued with close liaison between the Region's extension workers and the research officers from Trangie, Condobolin, and Cowra Stations.

A sum of $72,538 was allocated during the year by the Wheat Industry Research Committee to continue this adaptive research programme in the Region.

Extension Programme Planning.—Officers in Mid Western Region have for several years been involved in programme planning but the requirement was formalized this year. Each officer has now prepared an extension programme and a work plan related to the objective(s).

The Regional Supervisor has sounded the essential note of warning that the goals of the extension officers must be also the goals of the farmers, or so inter-related that in effect they are mutual, for extension to be truly effective in changing situations for the better.

Developing Extension Officers' Skills.—Conferences and informal sessions have been held at Regional headquarters, Cowra, to discuss extension methods and develop skills in survey methods and problem census as well as audio/visual aids equipment. Almost all extension officers now have active interest in face-to-face and mailed questionnaire methods of survey. They also are increasingly weighing sociological/psychological factors in extension, and especially the role of reference groups.

Meantime, technical subject matter skills are constantly being developed. Officers have attended technical training schools, seminars, and symposia for this purpose, and now have access also to much improved technical libraries at the Regional headquarters and District offices.

Northern Region

Livestock Trials and Demonstrations.—Ewe Lamb Mating trials were started, and provided important new information. The trials became focal points for sheep industry field days in this Region.

A new means of identifying cattle, freeze branding, has been demonstrated and promises to be an important improvement in management practice. In the few months since his appointment the beef cattle officer has become widely known through the demonstrations. Some 600 head of cattle have been branded, to show the method and also to assess factors that affect success of brands.

Freeze Branded

The method and merits of freeze branding have been widely demonstrated. Freeze branding seems likely to be accepted by producers as an important management aid in herd improvement programmes

Rural Surveys.—The Inverell District agronomist had done situation analyses in the Shires of his and adjoining districts and shown that development lagged in Ashford Shire. To find reasons that might lead to appropriate remedial activities he did a mail survey of rural holdings in the Shire, with the economics research officer and in co-operation with the Shire Council. From analysis of returned questionnaires it is expected that some research projects important to the Shire will be formulated.

The Regional poultry officer is surveying all farms carrying more than 3,000 laying birds, towards acquiring thorough knowledge of their management and farm costs. This is to assist his extension programme planning.

Farmer Organizations.—Agricultural Bureau Branches in this Region remained steady at six. Of these, Inverell and Bingara are the most active. Graziers Association Branches continue to show an interest in extension, in particular at Walcha and Glen Innes. Guyra Branch of the Potato Growers Association sponsored a successful potato field day and is in closer liaison with the Department than for many years past.

In the Inverell district a new group called Bannockburn Conservation Group, residents of the Bannockburn Valley, has formulated admirable extension group objectives.

Television.—The Northern and North Western Regions programme committee met late in 1967 to assess the Regions' current "Landmark" series presented by Tamworth's television station, NEN Channel 9. The weekly time slot of 1 p.m. on Sundays was assessed as unsatisfactory and further production was suspended.

The station appreciated the organization and presentation of programmes and the improving methods of the producers in light of experience gained. But although the station management wished the series to continue a preferred time slot was not available.

Subsequently, guided by a Television Rating Survey, the station offered a 5-minute weekly time slot at 8.55 p.m. on Tuesdays. Taping of the first four programmes for this new "Landmark" series started at the end of February, 1968, and the first session was televised in the first week of March, 1968.

The new weekly series, at the more favourable time and with improved presentation, has won increased support from participating officers and the station management. Viewers have yet to be surveyed.

North Coast Region

Dairy to Beef Production Trend.—There is in this Region a continuing swing by land users, from dairying to beef production. Recent statistics indicate some 34,000 more head of beef cattle in the Region this year. Even in Byron and Kyogle Shires, regarded as dairy strongholds there is now 21 per cent and 58 per cent of beef cattle, respectively. In fact, the large and increasing population of beef cattle is making it difficult for the Region's one livestock officer (beef cattle) to do more than touch the surface of the demand on his services.

Horticultural Extension/Research Liaison.—The first of a series of extension/research conferences in this Region was conducted by Division of Horticulture in May, 1968. There will be others, later in the year. The conferences are aimed at mingling the views of research and extension personnel by full discussion of situations, problems and objectives, and at keeping extension workers abreast of research findings.

Flood Relief.—Major floods occurred throughout the Region in June, 1967, but applications for flood relief were surprisingly few.

Officers were very busy during the flood in the Clarence area, and to a lesser extent on the Richmond, distributing fodder to stock stranded in high areas surrounded by water. One such Clarence River area held more than 4,000 head of cattle, and fodder supply was wholly by aircraft. Department of Agriculture officers stationed at Grafton distributed the fodder to stranded stock from the RAAF "Caribou" aircraft requisitioned by the Civil Defence Organisation.

Fact Finding Evaluation Surveys.—The agronomist-in-training made a survey of local offices' records of the North Coast Dairy Feed Year Assistance Scheme, to extract information needed by the Minister for Agriculture. The information included the acreage of grass topdressed and the acreage established to improve pastures as effects of the Scheme.

A dairy officer made a survey of dairy production in this Region, for the Commonwealth Investigating Committee for dairy Rehabilitation.

The Lismore District agronomist made two small surveys. One was a problem census in two Herd Recording Groups before forming each into a study group. The other was a survey of three Agricultural Bureau groups to evaluate the rapidity of adoption of a simple technique following an intensive extension programme in the area concerned. Comparisons were made with three similar groups where there was no such intensive extension programme.

North Western Region

The Agricultural Bureau.—The "new look" Branches of the Bureau, in major centres, have carried out active programmes in co-operation with officers of the Region. The Region has planned to form another two such Branches in 1968; one at Quirindi and the other at Gunnedah. Thereafter, formation of a Moree Branch would complete the coverage of all major centres in the Region.

A notable development in June, 1968, was the formation of a Regional Council of the Bureau to assist co-ordination of Bureau members' extension needs with the extension aims of Regional officers. The co-ordination will make possible the desired better use of extension resources.

Problem Census Survey.—A formal problem census was done in each of three centres of the Region, towards identifying the main problems of the area as seen by the farmers. Progress analyses indicate likelihood of wide disparity between problems as defined by farmers and problems defined by extension officers. Extension workers' programmes will undoubtedly benefit.

Problems raised by the farmers have in few cases been purely technical in character. This would indicate that rate of adoption of new or improved techniques by a majority of farmers may not increase unless extension officers present their information in terms relevant to farmer definition of the problem.

Farmers would appear also to be looking increasingly for more integrated advice, rather than specific technical advice which to them seems not to be answering their major problem.

The Regional staff intend to make greater use of the problem census method, both as a guide to extension officers and as a means of farmer involvement in agricultural education and problem solving.

New Sheep and Wool District Establishment.—Creation of a third sheep and wool officer District, with Gunnedah as headquarters, has greatly improved the extension situation in North Western Region. The appointment has been important and timely. Apart from the previous inadequacy, with only two sheep and wool officers to service an area of some 18 million acres, the narrowing profit margin in the sheep industry makes it imperative to raise the efficiency of production.

Southern Region

Drought Effects.—This Region underwent a particularly severe drought during the year. The drought "started" in the 1967 autumn with declaration of Gundagai Shire as a Drought Area.

Fortunately, there was sufficient rainfall in the late autumn and the winter of 1967 for sowing of a large area of wheat (about 800,000 acres). But because of the lateness of the rain, oat sowings were well down on previous years.

Wheat crops just managed to hang on, but moisture stress during the spring and early summer months caused many crops to be fed off completely and others were cut for hay. Those stripped for grain yielded about 15 bushels/acre. Harvesting was completed a month early. Much of the grain was pinched.

Pastures at no time received beneficial rains. The subterranean clover seed harvest was reduced to 257 tons, in comparison with 2,000 and 2,500 tons in the two preceding years.

Drought feeding was widespread, with wheat in large quantities from silos. Subterranean clover burr and the stubble bulk carried over from wheat crops were major assets in sheep grazing.

By March, 1968, all Shires within Southern Region had been declared Drought Areas. The Department prepared a well-documented brochure to farmers indicating what Government assistance was available to them. Surprisingly, many farmers made no attempt to seek available assistance.

Shortage of farm and domestic water supplies was the most serious problem. Cartage of water had to be undertaken over considerable distances and a long period.

Water Testing Increased by the Drought.—The need for farmers to seek underground water supplies was reflected in the increased number of water samples submitted to the Regional office for testing. Up to October, 1967, samples for testing averaged 30 a month. In November the number of samples increased to 78. A record of 232 samples was reached in January, 1968. Some rain was received in March, 1968, and more in April. This permitted fallowing for wheat, on a large scale, but not until May were good drought-breaking rains received over the whole Region.

Drought Feeding Education.—During the drought period, the livestock and veterinary officers conducted a series of drought feeding schools and extension officers in general handled countless inquiries regarding drought feeding and feed supplies.

Two Beef Cattle Officer Appointments.—In 1953, when Southern Region first operated, the senior livestock officer (pigs) undertook part-time beef cattle extension work. Subsequently, the Wagga Agricultural College lecturer in beef cattle took over this part-time role.

Appointment of a full-time beef cattle officer to Wagga late in 1967 has resulted in a much improved beef cattle extension service. Still further improvement was effected by the appointment of a beef cattle officer to Tumut in early February, 1968.

Private Rural Advisory Services.—The initial Wagga Group, subsequently so enlarged that a second Group formed, underwent a major change when the original Group's adviser left Wagga for private practice at Goulburn. His successor carried on until he established a private consulting practice at Wagga. The remaining Group has now so changed that it is in effect only a part of one adviser's private practice.

Private consultants located at Cootamundra and Holbrook are members of a team of consultants under the overall control of a Senior Rural Consultant at Albury. The rural adviser at Harden still operates with considerable success, for a separate Group.

There has been continued co-operation by Departmental extension officers with the private consultants and Group Advisers, within the Region. Notably, the existence of private consultants in this Region still brings about increased demand for Departmental extension service. This has been particularly so in Albury District.

South Coast and Tablelands Region

Regional Publication "Guide for Graziers".—Started 3 years ago as a monthly source of topical information for farmers and graziers on the southern tablelands the "Guide" is now sent to 300 of them. The Distrtict agronomists, livestock officers and veterinary officers contribute to the contents. The material prepared for it is incorporated also in the Yass Valley Organisation's Newsletter, a monthly with a distribution list of about 300.

These localized publications appear to be meeting a landholder need of constant reminders and advice on seasonal matters; reminders not otherwise readily achieved except by personal contact with officers.

South Coast Research and Extension Council.—This Council formed in 1965 has succeeded in raising sufficient funds over the past 3 years to support now the appointment of an additional research agronomist to the Department's Pasture Unit at Berry. The Council has undertaken to subscribe $5,000 p.a. for 5 years. This is a voluntary organization. The drive and enthusiasm of the executive is reflected by the undertaking reported here.

Yass Valley Organisation (Y.V.O.).—The Y.V.O. has been active on the "Operation Tintacks" project; joint CSIRO/Department of Agriculture applied research on farm development programmes with clear extension bias.

Over the years the Y.V.O. activities have attracted a number of sideline projects. Currently there is a sociological survey. This should be completed and reported on early in 1969.

The Yass Project Officer (a CSIRO officer; seconded) has been transferred to another Project in Queensland commencing in January, 1969. Therefore the Y.V.O. has invited other local farmer organizations to a public forum in July, 1968; to examine and review the "Operation Tintacks" project in particular but also the activities of Y.V.O. itself and research and extension in general.

South Western Region

Two New Extension Districts.—Two new extension Districts were established this year, an agronomist District at Hay and a livestock officer (sheep and wool) District at Coleambally, and the officers have been appointed.

Agricultural development in the Region is dynamic and production highly diversified. Specific technical advice in developing irrigation farms is a constant need exerting heavy demand on extension officers' time.

Resumption of Settlement at Coleambally.—Allocation of farms to new settlers in the Coleambally Irrigation Area was resumed early in 1968 with a ballot for 29 new farms. There were more than 1,300 applications. Resumption of the settlement in this area, together with other private irrigation schemes developing in this Region will further increase the demand on extension services.

Schools for Irrigation Farmers.—This year two special schools were held for Coleambally farmers and another has been projected. Also, a special 2-days Irrigation School was held for 200 farmers who will be members of the West Corurgan Scheme at present under construction.

Research/Extension, Farmer Relationships.—Close liaison has been maintained with Coleambally Branch of the Agricultural Bureau. This voluntary organization for extension is playing a most important role in progress of the new settlement.

Close farmer relationship with research/extension has been maintained also through the *Irrigation Research and Extension Committee* (I.R.E.C.) which has existed for many years. Extension officers from all Divisions of the Department in the Region attend a large number of sub-committee meetings of this committee, and of the *Murray Research and Extension Committee*, for planning and co-ordination of research and extension projects.

The very high adoption rate of new information for the rice industry is long established and due in large part to the very close liaison in this Region between research workers and extension officers and between these and farmers, through I.R.E.C. and the rice industry organizations.

Western Region

Effect of Field Assistants.—The four field assistants located in this Region travelled a total of 48,000 miles in official vehicles in the course of providing assistance to extension officers. Most of this travelling was for the establishment, maintenance and recording of results of trials and demonstrations. Much of this work was without the presence of the respective extension officer. Release of the extension officers from these routine aspects of the trials and demonstrations work allowed them more time for extension of the results.

Commercial-Size Farm Demonstrations.—Extension officers are enthusiastic about the extension value of commercial-sized farm demonstrations to speed up the rate of adoption of research findings. The Graziers Asscociation in Oberon-Bathurst area is playing a leading role in assisting extension of results from commercial-sized farm demonstrations established there.

Improved Extension Services for Warren and for Bathurst.—Establishment of an office at Warren and the appointment of a District agronomist and a District livestock officer (sheep and wool) to service the Warren, Coonamble and Bogan Shires have much improved the extension service in the western half of Western Region. A notable side-effect is that the Dubbo agronomist and sheep and wool officer Districts have been reduced to workable areas because of the Warren appointments.

Horticultural extension in the Bathurst area will benefit from establishment of a District fruit officer position there. An officer-in-training has been attached to the Bathurst Agricultural Research Station in preparation for appointment as Bathurst District fruit officer.

Use of Mass Media.—Every effort has been made for balanced use of press, radio and television to provide an effective cover of the Region.

A 16-page supplement was prepared for the *Bathurst Advocate* in November, 1967. It featured co-operative demonstration work conducted with farmers in the Bathurst-Oberon area and was well received. Producers in the area are holding it as a reference publication.

The 12–15 minutes fortnightly television programme "Farming To-Day" which commenced on C.B.N. Channel 8 at Orange in 1963 was replaced as from 4th July, 1967, by a 3-minutes session each Tuesday and Thursday. This new format has been well received. The channel also still accepts news segments.

The National Field Days at Orange.—Themes of the exhibits by the Region at the 1967 National were "Selection for Fertility in Sheep", "Protein Feeding Trials for Pigs" and "Storage Disorders of Apples and Pear".

The Commonwealth Extension Services Grant (C.E.S.G.)

Prior to 1st July, 1967, there were two separate Grants through the Commonwealth Department of Primary Industry to assist extension services in the States; the Dairy Industry Extension Grant and the Commonwealth Extension Services Grant. From that date the whole is dealt with as one Grant —the C.E.S.G.

Total of allocations for the N.S.W. Department of Agriculture for 1966–67 had been $547,800. It was $752,100 in 1967–68.

The Chief of Division of Extension Services is responsible to the Director-General for the administration of the fund.

The fund has been used for—

- appointment of additional extension and research staff, and appointment of additional field and laboratory assistants to assist in the Department's adaptive research programmes;
- provision of specialized research equipment and instruments, including construction of further regional laboratories and other smaller buildings associated with research;
- provision of materials for field demonstrations, and of motor vehicles needed in the establishing and maintaining this work;
- purchase of extension aids equipment such as cameras, various types of projector, tape recorders, public-address systems, videotapes, etc.; and the maintenance of existing equipment and supplementary supplies;
- publication of certain books;
- library purchases of reference books and placement of subscriptions for periodicals, for research and extension officers;
- financing overseas study tours for officers;
- financing conferences and some of the in-service training;
- continuation of the Grade Herd Recording scheme, as the basis of dairy herd improvement.

HAWKESBURY AGRICULTURAL COLLEGE

General

TRENDS

The College continues an active development period, and not only in terms of the building programme. The stated intentions are to present by 1970 not only *tertiary* courses in the three current Diploma fields—Agriculture, Dairy Technology, and Food Technology—but also new courses. These will be Poultry Technology and Rural Extension.

This year has seen progress in policy determinations directly related to the objective of providing tertiary training to a somewhat more mature and sophisticated student body. The end products will be able to hold their own technologically with any three-year graduates, other than in research.

ANTICIPATED EFFECT OF INSTITUTE OF RURAL STUDIES

Arising from the decision of the Minister for Agriculture to set up an Institute of Rural Studies in N.S.W., a Committee of Advice has been meeting in recent months to make recommendations concerning the constitutional powers, authority, objectives, duties and functions with which the Institute should be vested as a statutory body. The Institute is expected to be a powerful and constructive force in assisting the College to reach its tertiary objectives.

THE BUILDING PROGRAMME

Students and staff now enjoy excellent teaching facilities as a result of complete renovation of the Science Block.

The Dairy Research group has moved into a new, modern research building providing improved working conditions and an expanded range of first-class equipment.

A contract has been let for construction of Stage I of the Animal Husbandry building. Many minor building and renovation projects were concluded.

Aided considerably by Commonwealth funds, an accelerated building programme will continue in the years immediately ahead. For example, under the Technical Training Grants Programme, $498,500 has been allocated for the triennium commencing 1st July, 1968. Substantial funds are anticipated under Advanced Education grants during the triennium beginning 1st January, 1970, and, from the same source, funds are at present available to provide a Food Technology tutorial block, an additional residential block, teaching facilities for Poultry Technology, and miscellaneous equipment and furniture.

PROPOSED NEW COURSES

Decisions having been taken to introduce a 2-year Diploma Course in Poultry Technology and a post-diploma 1-year course in Rural Extension, action is proceeding with a view to their commencement in 1970. Also, a Third Year in the Dairy Technology Course is intended for introduction as soon as the staff position permits and preferably in 1969.

SENIOR TEACHING POSITIONS ESTABLISHED

Senior positions, designated Chief Lecturers, have now been established. There is one for each Diploma course. Each Chief Lecturer will be administratively responsible for the respective course, for leadership and guidance to teaching staff, attention to curriculum improvements, and for other matters. His duties will include a small lecturing load. The staff framework will be re-inforced at an early date by a number of other senior teaching and administrative positions.

The Three Diploma Courses

STUDENT NUMBERS, QUALIFICATIONS, AND MOTIVATION

Agriculture Diploma.—At present 177 students are in the Diploma of Agriculture Course; 51 in Agriculture III, 62 in Agriculture II and 64 in Agriculture I. Fifty-eight are sons of farmers and graziers; 20 in Agriculture III, 17 in Agriculture II and 21 in Agriculture I.

Of the 64 students admitted into Agriculture I in 1968, 50 possessed the Higher School Certificate (or equivalent) and 14 the Leaving Certificate or 5th Form background.

Not less than 41 of the 64 students enrolled in Agriculture I in 1968 have expressed a definite intention to seek career positions in Government service or private industry after graduation. Of the 18 students with indefinite intentions at this early stage, it may be assumed that most are considering career positions. Only five of the 64 have definite plans to go on the land.

Dairy Technology Diploma.—Forty students are currently enrolled—20 in First Year and 20 in Second Year.

Admissions to First Year in 1969 included 16 from New South Wales (7 Dairy Factory Apprentices), 3 from South Australia, and 1 from Tasmania. One student, with special qualifications, was admitted direct into Second Year.

Food Technology Diploma.—Seventeen students are currently enrolled; 13 in First Year and 4 in Second Year. One student is from South Australia.

All students admitted to the Food Technology Course in 1968 possess the Higher School Certificate or equivalent qualifications, with English, Mathematics and Science as compulsory passes.

ASSISTED STUDENTS

Of the 234 students in residence in 1968 for Agriculture, Dairy Technology and Food Technology Diploma courses, 160 (68 per cent) are in receipt of bursaries, scholarships, traineeships or other forms of sponsorship. Forty-two of the 160 are Public Service trainees, for the Department of Agriculture or Department of Conservation.

Seven of the 17 Food Technology students have financial assistance by way of sponsorship or scholarship. The Food Technology Association of New South Wales has notified plans to provide a scholarship for a student to enter in 1969.

DIPLOMAS AWARDED—MAY, 1968

Agriculture.—The Diploma in Agriculture was awarded to 35 students from the 1967 class. One student gained Honours Class I and four gained Honours Class II.

Dairy Technology.—Fourteen students from the 1967 class were awarded the Diploma in Dairy Technology. One gained Honours Class I and four gained Honours Class II.

Food Technology.—Nine students from the 1967 class were awarded the Diploma in Food Technology. The Dux gained Honours Class II.

EMPLOYMENT OF THE RECENT DIPLOMATES

Agriculture.—The 35 diplomates from the 1967 class have employment in the following fields:

On farming and grazing properties	5
In Government Departments:	
(a) State Departments	16
(b) Other Government Agencies	0
In Private Firms (Agricultural Supplies and Services) as Technical Representatives, etc.	7
In Companies associated with Agricultural and Pastoral Industries	2
In University studies	1
Miscellaneous or not known	4

Dairy Technology.—Of the 14 diplomates from the 1967 class, eight are currently employed in New South Wales, one is in the army, two are employed in South Australia, and one each in Western Australia, Tasmania and Singapore. Three of the 14 diplomates are in Government positions.

Food Technology.—Of the nine diplomates from the 1967 class, six are now employed in New South Wales, two in Victoria and one in South Australia.

COMPARATIVE STATISTICS FOR ALL COURSES

STUDENT ENROLMENTS 1959 TO 1968

Diploma Course	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968
Agriculture	187	190	192	187	189	192*	181	180	173	177
Dairy Tech.	33	32	32	32	31	25*	35	36	36	40
Food Tech.	17	15	19	25	28	22	23	21	16	17
	237	237	243	244	248	239	239	237	225	234

* Includes one 1962 student permitted to attend 1963 final exams.

EDUCATIONAL STANDARDS OF 1967 AND 1968 ENTRIES

	Agriculture Percent		Dairy Technology Percent		Food Technology Percent	
	1967	1968	1967	1968	1967	1968
Higher School Certificate (or equivalent)	..	78	..	80	..	100
Leaving Certificate or 5th Form (or equivalent)	94	22	90	20	100	..
4th Year School Certificate	6	..	5	..	..	..
	100	100	95	100	100	100

THE DIPLOMAS AND YEAR PASSES AWARDED, 1963 TO 1967

	1963	1964	1965	1966	1967
Diploma in Agriculture	53	47	50	58	35
Diploma in Dairy Technology	13	11	13	18	14
Diploma in Food Technology	13*	11	8	11	9
Passed 2nd Year Agriculture	51	49†	57	37	51
Passed 1st Year Agriculture	57	65†	36	56	58
Passed 1st Year Dairy Technology	12	10	17	14	19
Passed 1st Year Food Technology	11	8	12	8	4

* Includes one 1962 student permitted to attend the 1963 final examinations.

† Includes one 1963 student permitted to attend the 1964 final examinations.

DEVELOPMENTS IN THE DIPLOMA COURSES

Dairy Technology.—There has been continuing improvement in this 2-year course. Transference of part of the Market Milk course to First Year has provided time for a new Laboratory Techniques course in Second Year. This will supplement practical laboratory training and the existing all-day practical examination in the subject. These changes correct a longstanding deficiency.

An optional Third Year in Dairy Technology is intended to be introduced in 1969. The curriculum, staffing and physical requirements are receiving attention.

Food Technology.—In line with higher entry standards, curriculum changes are being made and scope of the course is being increased. Unlike the Dairy Technology Course, there is no immediate plan for a Third Year. But this is a possible development.

Funds have been allocated to construct a well-equipped Tutorial Block comprising a lecture theatre, a reading and audio-visual aids room, four laboratories, preparation and storage area, ancillary service units and four offices. Future food-processing facilities will provide for instruction in cereal processing, e.g., testing and utilization of flours in baking.

PRACTICAL TRAINING IN ALL COURSES

Considerable emphasis is placed on practical training for the students in the three Diploma Courses. Satisfactory practical experience is being provided through field work and factory activities, extra-mural training, organized demonstrations and tours.

EXTRA-CURRICULAR ACTIVITIES AND PUBLIC RELATIONS

Extra-curricular activities continued to be important in student life. The various teams observed the high tradition of College sport. Positive contributions were made to the social life and welfare of the College by the Students' Representative Council, the Sports Club, the Debating Society, the Camera Club, the Students' Christian Movement, the College Branch of the Agricultural Bureau and the Hawkesbury Collegians Service Club.

Arrival of visitors on the regular Visitors' Day (Thursday) is so consistent that members of the staff and students continue to be rostered for the occasions. By special arrangement on other days, including weekends, individuals and groups have been allowed to inspect the College. Some of these visitors regard the College as a tourist attraction but most have a real interest, general or specific, in its activities. The visits are accepted by the College as effective forms of extension as well as media of good public relations.

The College continued to be visited by agriculturists from other States and from overseas, including many from Asian countries. There has also been continued liaison and co-operation with many government, semi-government and private organizations, viz., other State Government Departments, the Commonwealth Department of External Affairs, the CSIRO (several Divisions), the Atomic Energy Commission, Australian Broadcasting Commission, Universities, Banks, Local Government bodies, primary industry organizations, the Agricultural Bureau and the Rural Youth Movement, various technical societies, and many companies associated with agriculture.

Short-term Schools and Conferences at Hawkesbury

Short-course schools and conferences held at the College during the year included: the Department's Extension Service/Methods School (52), Herd Recorders' School (44), Dairy Factory Operatives' School (12), Sheep and Wool Seminar (47), Research Station Managers' Conference (23), and staff Reporting School (21); a Rural Youth School on Horse Management (20) and another on Beef Cattle (23); the School for Poultry Farmers (26), School for Pig Raisers (38), Friesian Cattle Club Judging School (38), School for Factory Foremen (Food Plant) (45), and Milking Machine Operators' School (15); and the 43rd Annual State Congress of Agricultural Bureau (120).

Some College Sectional Operations

FARM; AGRONOMY RESEARCH; ORCHARD; HORSES; SHEEP; BEEF CATTLE; DAIRY CATTLE; POULTRY; PIGGERY; APIARY; CANNERY; DAIRY PRODUCTS FACTORY

Farm.—The 1967 autumn had favoured establishment of cereal crops and the regeneration of winter pastures, but the dry winter reduced plant growth. The spring was dry early, and only the irrigated areas provided fodder. Light, scattered rainfalls of early summer mostly favoured the cereal crops, particularly on the light soils. Heavier rains in late October and early November reduced by 10 per cent the crop on low lying areas and were too late to increase hay yields. Some 350 acres had been sown to barley, oats and wheat, in the 1967–68 season, and 350 acres was sown again in 1968.

Summer crop production was again confined to the irrigation area at the River Farm; 20 acres of maize and sorghum for silage for dairy cattle.

Basically white clover summer pastures have been seeded for dairy hay supply. These areas also suit autumn sod-seeding of oats, and beef cattle grazing through the winter.

Failure of lucerne hay production at the River Farm was compensated by the quality pasture hay from white clover areas and surplus spring growth from the Richmond irrigation area. This allowed over 130 ton of hay to be stored at the Dairy Section and more than covered the year's hay requirement. Only 60 ton of lucerne hay was produced from 19 Clarendon acres, because cuts were lost through adverse weather. But the 60 tons, made possible by using sewage effluent water, is of extreme value in the supplementary feeding.

At 30th June, 1967, the cereal hay reserve was 230 tons. During the year about 120 ton of sheaf hay was fed to horses and 50 ton of baled hay to cattle. The harvest produced 100 ton of baled hay and 180 of sheaf hay; so 340 ton is in reserve at 30th June, 1968.

Pasture hay harvests yielded 165 ton whilst 120 ton was used, and 62 ton is in store. Lucerne hay chopped and fed to stock amounted to 110 ton whilst production replaced 50 ton, leaving 60 ton in store.

About 650 ton of green material including cereals and summer crops was cut for silage. Ample silage has been available to the dairy and other stock and there is 1,200 ton in reserve.

Only three tractor firms now regularly replace "on loan" equipment. Cost of maintenance of the aged "on loan" tractors is high. Overall, however, the farm machinery position has improved over recent years with less dependence on loan equipment.

Agronomy Research.—Accommodation in the Agronomy Section remained inadequate but is under attention. It is affecting the research. A newly revised plan has been submitted, on the lines suggested by the Deputy Chief of Plant Industry.

District trials were again carried out by the agronomists as part of their research programme. Seeds of vegetable varieties and new plant breeding materials were sent also to research stations, interstate and overseas.

Co-operative research work was done with the University of Sydney Wheat Research Unit, the CSIRO Division of Food Preservation, various Divisions of this Department, local farmers and commercial firms. In the continued co-operative weeds research with Geigy Australia Pty Ltd two officers of the company are located at the College and working with the College agronomists.

Various aspects of the agronomy research programme were subject of lectures and demonstrations for college and university students.

The research agronomists submitted to the Chief, Division of Plant Industry, their annual technical reports for incorporation in the report of that Division. Their reports dealt with weed research, plant nutrition research, field crop research and vegetable breeding.

Orchard.—Further areas of the orchard were reconstructed by removal of old and planting of new trees. The nursery areas have been valuable as a teaching aid and source of planting material.

The citrus variety collection including a large range of mandarins and of lemons, some oranges and other citrus types has been well maintained.

A peach variety trial comprising 19 peach varieties, 57 trees in all, was established in 1967. Some new yellow-fleshed nectarines also have been propagated, preparatory to planting a trial area.

Selected strawberry seedlings are in further plantings. None as yet is comparable with Torrey, the variety still regarded as best performer in these conditions.

A herbicide demonstration plot established in citrus trees although only a small area, has already been a useful extension aid. A "Drag hose" supplementary irrigation system has also been installed, as a district extension aid as well as for student instruction.

Demonstrations and discussions on various horticultural practices were provided for visiting groups, including the Agricultural Bureau and Rural Youth Movement.

The orchard statistics at 30th June, 1968, were: area, 12 acres (approx.); 1,280 trees; 450 vines; 16 types of fruits and nuts; 118 varieties of fruits and nuts; 1967–68 new plantings, 62 trees; 1967–68 removals, 40; 1967–68 trees and vines propagated, 1,000; 1967–68 production—about 1,000 bushels of citrus fruits, stone fruits, pears, and grapes. Adequate fresh fruits for College needs were supplied through the year, and some fruit was supplied to the Cannery section.

Horses.—College horses totalled 58 at 30th June, 1968, three more than at 30th June, 1967. Eight foals were gained but two colts and three mares were sold.

Sheep.—The demonstration project to compare wool production from Merino wethers at various stocking rates has been abandoned. A demonstration to compare grazing management systems and the use of cotton seed meal supplement in prime lamb production is in hand. The other demonstrations are being organized, (a) to compare effects of different castration treatments on lamb growth rate and (b) to compare effects of various anthelmintic and management treatments on lamb growth rates. The Sheep Section is co-operating also with Glenfield Veterinary Research Station in investigating *Trichostrongylus* spp. development of tolerance/resistance to certain anthelmintics.

Further areas of irrigation have been acquired for the Sheep Section, making about 60 acres now available for demonstrations. Their redesign and fencing as a grazing demonstration unit are proceeding.

The Sheep Section statistics at 30th June, 1968, were: 1,119 sheep; including 268 commercial flock ewes, 171 Merino flock ewes, 61 Merino hogget ewes, 65 crossbred hogget ewes, 30 Merino rams, 32 demonstration rams, and 492 ration sheep. The 1967–68 shearing yielded 50 bales, a gross of 15,503 lb greasy wool. In the commercial flock, 156 per cent "lambs marked" resulted from mating 260 ewes and in the Merino flock 89 per cent "lambs marked" resulted from mating 188 ewes.

Beef Cattle.—Significant developments in herd organization were achieved.

In the *Poll Hereford Stud*: Recent purchases, of a new sire "Kildrummie Youth" from Mr D. Carnegie, "Kildrummie Stud", Holbrook, and three heifers from Mr A. Locke, "Wirruna Stud", Wagga Wagga, have increased the available genetic material. The new material has facilitated an intensive culling programme, to remove family lines at all related to imported dwarf-carrying strains. No dwarfism has shown within the College herds but the policy is justified by dwarf incidence in some Poll Hereford herds in Australia.

Quality and performance of the Poll Hereford herd have significantly improved through the influence of the present top sire "Kildrummie Toledo", also the intensive production selection practices in replacing heifers and in sire selection. These demonstrations have been invaluable in student instruction.

Statistics at 30th June, 1968, for the Poll Hereford Stud: 64 females, including 20 weaners and calves at foot; 15 males, including three on loan to Graham Park Artificial Insemination Centre, Berry, one adult sire and one recently purchased yearling bull standing at the College; eight yearling bulls in a sire selection demonstration. Three yearling bulls from the previous year's programme were sold to private studs.

In the *commercial herd* the accent has been on continued expansion to meet student instruction needs. Quality and performance of this herd have significantly improved because of better quality sires from the Stud herd and better quality replacement females.

Beasts from the Steer Production Demonstration were again exhibited in the Royal Agricultural Society Steer and Carcase Competition. The pen of three steers gained the award of First, for "on the hoof", for steers over 900 lb liveweight, 2–4 tooth class. A single steer was placed third in a "single steer class, milk tooth, under 900 lb liveweight".

Size of the commercial herd has been expanded to approximately 60 breeders. Cull animals and steer progeny have been used for ration purposes by the College.

In the *Demonstration Herd* the range of material produced for student instruction programmes has more than vindicated the establishment efforts. A notable acquisition has been by purchase of a Brahman bull of outstanding quality, "Lawes Scimitar" from the Queensland Agricultural College. This obviates need to continue artificial insemination of the Demonstration herd, to produce a range of Brahman x British Breed hybrids. He has completed his first season; paddock mated to 40 females from various beef and dairy breeds and crossbreeds. The dairy breed females have been included to evaluate dairy/beef crossbreeding practices.

Prior to acquisition of the Brahman bull, a similar programme was undertaken by artificial insemination. The first of the Brahman hybrid calves from that programme is now 12 months old. The animals, although few, have been impressive, especially the first Brahman x Friesian hybrid. This recorded outstanding production and being a rather unique cross was given wide press, radio, and television publicity. Later animals of similar breeding confirm the outstanding growth performance.

Other Brahman hybrids have been produced, from Australian Illawarra Shorthorn, Red Poll, Poll Shorthorn, Poll Hereford, and Angus. The A.I.S. hybrid has promising potential. The others are yet too young to assess.

From the *Ration Herd* 88 were slaughtered this year, comprising culled animals from the other herds, College-produced steers and some received from other Research Stations.

At 30th June, 1968, there were 293 head of beef cattle at the College, in all herds.

The long term demonstrations in hand for student instruction comprised: "Breeding Herd Management", emphasizing herd improvement and fertility, including pregnancy diagnosis, at stud and commercial levels; "Steer Production", including economic assessment of steers in pasture management systems and a Feed Lot finishing programme; "Production Selection of Replacement Heifers", stud and commercial; "Sire Selection", on production and visual classification; "Nutrition Management", in all herds, including feed year planning and the utilization of irrigated pasture under intensive grazing systems; and "Breed Influence on Crossbreeding Practices", comparisons of various cross breeds under similar environmental conditions.

Dairy Cattle.—The breeding programme this year was again based on Canadian bred bulls and bulls sired by them. One of the top Canadian sires in artificial insemination activities, "Frasea Lord Jewel" is now 14 years old. His semen is therefore now reserved for selected matings.

Bulls placed by the College in Artificial Breeding Centres have been important in the College breeding programme. This will continue but to a lesser extent. Natural service is being done to a greater degree, using "Hawkesbury Countess Voyaguer 2nd" and a recently repurchased bull "Hawkesbury Lenora King 2nd". The latter, a full brother to the Artificial Insemination Centre bull "Hawkesbury Lenora King 4th", has daughters milking exceptionally well.

"Golden Valley Rex", the Champion Friesian bull at the Sydney Royal Shows of 1966 and 1967 was loaned to the College for collection of semen for use in the herd. He has been used over some of the top cows to evaluate his use in raising production in the College stock.

Statistics for the Friesian Stud show 147 head at 30th June, 1968, comprising: eight adult bulls, six loan bulls, 49 cows in milk, nine dry cows, 20 heifers, and 55 calves under 12 months old. Births for the year totalled 63 comprising 30 males and 33 females. Twenty-six head of stud stock were sold, for a total of $6,255 and an average of $241. Demand for the College stud Friesians is still very high. The waiting list for College bulls extends for 2½ years ahead.

The latest released herd recording figures are for the 12 months ended 30th June, 1967. The College herd was second from top herd in the State for butterfat production, and fourth from top for milk production for herds of over 40 cows.

The College team of 16 Friesians exhibited at the 1968 Sydney Royal Show gained 12 Firsts, seven Seconds, seven Thirds, two Fourths, and one Fifth. The College also gained the "Most Successful Exhibitor" award, for the eighth consecutive year, and the "Most Successful Breeder" trophy. Two young bulls were sold by auction at the Show, for a total of $975.

The College exhibited also at the Hawkesbury District Show where it gained seven First, one Second, five Thirds, and the Champion Bull and Champion Cow awards.

The Solids-not-Fat Trial continued and is now important in the culling programme.

Poultry.—The *6th Pure Breeds Test* ended in December, 1967; 462 days after hatching. Interim and final reports were published. The *7th Pure Breeds Test* started in August, 1967.

The *15th Random Sample Layer Test* ended in November, 1967. Interim and final reports were published. The *16th Test* started in August, 1967. The 25 entries included four in the Development Section, an innovation allowing breeders to test strains not yet up to commercial numbers.

There were insufficient entries to conduct a *Random Sample Broiler Test* and broiler tests have now been abandoned because of the changing conditions in the broiler industry.

At the Annual Poultry Farmers' Field Day a record number of firms exhibited and a crowd of 1,200 attended. Theme of the day was "Practical Nutritional Management".

Besides providing student instruction the Poultry Section was venue of a short-term school in Poultry Farming during the spring vacation.

Piggery.—Sixty-three litters were farrowed for an average of 10.35 pigs per litter.

A number of new blood lines were introduced. The boars introduced were "Glen Lea Phillip 580th", a Large White from Messrs R. J. and Y. M. Bryson, Glenlea Stud, Penrith; "Balarang Topper", a Berkshire from Mr C. W. Dent, Balarang Stud, Warnervale; "Glenwarra Comanche 21st", a Tamworth from C. Hannon and Son, Glenwarra Stud, Menai; and "Wollongbar Starboy", a Large White transferred with a Large White sow "Wollongbar Lady 8th" from Wollongbar Research Station.

The breeding stock now comprise 1 Tamworth boar and 4 sows, 3 Berkshire boars and 6 sows, 3 Large White boars and 13 sows, and 3 Landrace boars and 12 sows.

Demand for College stud stock has been exceptionally strong throughout the year, particularly in requests for stock of mating age. The demand could not be met, even for young stock 3 to 5 months old, but 64 stud animals (for $3,225.50) and 94 commercial pigs (for $2,236.75) were sold.

The annual School for Pig Raisers was fully attended and successful. A four-days School for Rural Youth was also conducted by the Piggery Section.

In statistics from the Piggery Section it is notable that 63 litters were farrowed this year, for an average of 10.35 pigs per litter. At 30th June, 1968, the stock in hand totalled 304 head.

Apiary.—Most of the colonies overwintered well, with ample stores from the previous autumn honey flow. Hive populations built up earlier than usual and queen rearing nuceli were stocked from them. Spring breeding conditions were favourable too.

Twenty nucleus hives were drawn in September from the bees at Tamworth, to establish a research apiary for the officer returning in that month from the U.S.A. Another 20 single colonies were stocked at the end of October with bees from Tamworth, to establish an apiary for an officer at Orange to record Nosema disease incidence there. Temporarily these were placed at Bathurst Research Station. Other productive hives were migrated to Bathurst in November because of excellent honey flow from Yellow Box and Red Gum.

Some 10,860 lb of surplus honey was extracted this season, after leaving enough for the colonies' winter needs.

Queen bees were in greater demand this year. A record total (750) was supplied, mainly to beekeepers in N.S.W. and Victoria, but some in Queensland and Western Australia. Among them were six artificially inseminated Breeder queens.

Because accommodation was not available the usual summer vacation School in Apiculture was not held in 1968. However, demonstrations were given at the Amateur Beekeepers' Association Field Day at the College on 24th February.

At 30th June, 1968, the apiary comprised 100 production hives and 50 nucleus colonies, compared respectively with 85 and 40 at 30th June, 1967.

Cannery.—The products of the College cannery in 1967–68 were: jam; canned and dehydrated fruit; fruit juices; canned, quick frozen and dehydrated vegetables; tomato juice, sauce, and soup; and various dessert materials—custard powder, jelly crystals and lemon butter; 12,780 lb in all.

Apart from the Diploma students' course, the section conducted the 9th School for Factory Foremen in the Food Plant. This was in association with the Food Technology Association of N.S.W. A maximum limit of 40 was set but had to be increased to 45 because of industry demand for the Course. Thirty-one firms sent personnel, ranging in status from foreman to higher supervising or management posts. Twenty-one of the 45 were from N.S.W., 10 from Victoria, 5 each from Queensland and Tasmania; and 4 from South Australia.

Planning of new facilities and equipment for an initial expenditure of $300,000 allocated under an advanced education vote is in hand although site has yet to be decided. The advantages of a "School of Technology", a complex of Dairy Technology and Food Technology. sited near the College Dairy Factory have been promulgated.

Dairy Products Factory.—Intake of surplus milk has been adequate for the practical training. Nepean Milk Co. continues to supply 2,000 gallons of pasteurized skim milk per week. Possible increase to 4,000 gallons per week depends on College acquisition of a new roller dryer. This will be as soon as funds permit.

Supplies of cream for butter production have diminished but adequate practical instruction has been achieved. Instruction in cream grading has been helped by weekly supply of small iced samples from Singleton Co-operative Dairy Co.

Packet sales of ice cream have increased but these and the College dining room outlet are barely enough to sustain the desired once-weekly manufacture. Other outlets have been sought, so far without useful result.

Cheddar and skim milk cheese manufacture continued. Manufacture of non-cheddar varieties (Edam, Swiss, Roman, Blue Vein, Processed and Cottage) and Yoghurt were also demonstrated. With demand now for pure fruit Yoghurts, this type also was manufactured.

The 2,000 gallons of skim milk available each week has been largely used in the by-products section although about half of this intake went to the cheese section in the periods of seasonal shortage of whole milk. A programme of practical instruction in spray drying, laboratory testing, and recombining to sweetened condensed milk and evaporated milk has been instituted. The Recombined Milk Plant was completed early in the year and Second Year students are now instructed in the manufacture of milk powders, specifically for recombining, and in the recombining process.

Dairy Factory statistics for the year comprised: 201,680 lb butter produced (320,896 lb in the previous year); 175,237 lb cheese produced (222,612 lb in the previous year); intake of 2,349,427 lb milk from the Nepean Milk Society surplus (3,262,150 from this source and 78,815 lb from United Dairies surplus in the previous year); 3,288,922 lb milk pasteurised (3,135,281 lb in the previous year); 419,424 lb milk handled from other sources (340,617 lb in the previous year); 2,252 gallons ice cream produced (1,916 gallons in the previous year)· 107,307 lb dried milk (97,350 in the previous year); 7,245 lb condensed milk produced (nil in the previous year); 920 half pint cartons of flavoured milk produced (9,008 in the previous year) and 96,044 lb skim milk received (73,012 in the previous year).

Dairy Research Section

GENERAL

The new dairy research building was completed. It is well equipped. The features include a Gas Liquid Chromatograph, Infra Red Milk Analyser, Zeiss Spectrophotometer and equipment enabling use of radio active isotopes.

The Principal Dairy Research Officer (P.D.O.) position was filled in October, 1967. He has since visited dairy factories and attended conferences to assess research needs of the industry, in dairy husbandry and in manufacturing. As a result, a plan for overall organization of the dairy research group has been developed, and submissions have been made for the staff needed in the research programme.

Three officers have visited research establishments and dairy laboratories in Melbourne and in April all research officers attended the annual A.D.P.B. conference in Brisbane. These opportunities to meet other workers in their fields and to get the overall picture of dairy research being undertaken in Australia has been stimulating experience. One research officer attended a month's course organized by the Australian Atomic Energy Commission on use of radio active isotopes. In consequence the radio active isotope techniques will be used for the detergent project.

The Dairy husbandry group have continued close liaison with manufacturers of milking machines, detergents, and sanitisers. The close co-operation means continued improvement in quality of equipment available to farmers.

The staff have lectured to various organizations, and the senior research officer has conducted two 1-week courses on Milking Machine Testing and general milking management.

RESEARCH PROJECTS

Milk Powder Project.—In the previous season there was shown to be little change in the heat stability of skim powder made from milk supplied to the College factory. This work has now been expanded to include the milk and powder from country factories manufacturing to the Australian Dairy Produce Board (A.D.P.B.) standards. *Inter alia* it is to include operation of factory plant by research technicians trained to do this, so that batches of powder may be made to specifications and then manufactured into condensed milk in the recombining plant at the College factory.

Infra-Red Milk Analyser (*IRMA*) *Project*.—The results from chemical analysis and from I.R.M.A. for butterfat, protein and lactose in milk have been compared. The results from I.R.M.A. showed a drift from day to day. Floor vibrations were responsible. So further work was delayed until I.R.M.A. was installed in the new research building. There, adjustments to the machine and to the homogeniser were shown to be needed. Progress on this project will still be slow, until adequately trained staff are available to operate the machine. The research officer for the I.R.M.A. project is in touch with Canadian workers who are successfully analysing 3,000 milk samples per day.

Processed Cheese Project.—Work continued on use of nisin to control the blowing of cans due to spore-forming bacteria. The cans must be incubated for up to 12 months to assess whether the nisin has remained effective in inhibiting the spores' germination.

The writing up of certain aspects of cheese processing is proceeding. In due course the outcome will be published as a manual on cheese processing.

With expanded support from the A.D.P.B., the development of equipment to measure the physical properties of processed cheese has been started. This is first stage in a programme to study factors influencing the properties of processed cheese. Among the factors are the raw cheese used, the emulsifying salts added, and the conditions of processing.

Advice has been given to users of Australian cheese for processing in Japan. Also, planning of a cheese processing plant for the Philippines has been assisted.

Milking Machine Management.—A report on the results (1960 to 1966) of the Milking Machine Survey was submitted to the Chief, Division of Dairying in April, 1968. Recommendations to bring the survey into line with present needs of the industry were computed. Widening of the duties of the Milking Machine Survey Officers, to permit use of these officers in the related fields of bails and shed design has also been recommended. Appointment of a Dairy Officer to specialize on bails and shed design in relation to milking efficiency has also been proposed.

The Senior Dairy Officer (Research) continued active participation in the Standards Association Committee for milking machine standards. Final standards have been drafted re vacuum regulators and end of milking indicators. These drafts are in circulation for a postal vote on their acceptability.

Considerable knowledge and experience on milking machine performance, the cleaning of milking machines and to a lesser extent on bail and shed design has now been built up by the Milking Machine Research Group. A team approach to the following inter-related topics has been proposed in consequence: (a) Milking Machine design; (b) Milking Machine efficiency; (c) Bails design; (d) Shed design; (e) the effect of each of those on how many cows can be milked per hour; (f) the efficiency of cleaning of the milking machine; (g) the efficiency of the sanitising of the milking machine and other milking equipment, and the sanitising of the cow's udder and the milker's hand.

Dairy Detergents.—A technique for removal of milk stone from soiled metal slides without removing any of the metal itself has now been devised. This has made it possible to assess accurately whether changes in weight are due to milk stone build up, corrosion, or a combination of these. Therefore the milking machine simulator is now a basic research tool for evaluating cleaning systems.

The Dairy Detergents research group is represented in the Committee set up by the Standards Association of Australia (S.A.A.) to recommend standards for dairy detergents. After two meetings the Committee decided it was not possible to set standards for dairy detergments on the chemical analysis of the composition, and that the present milking machine simulator was too complex to use a standard procedure. The Committee is now seeking simple methods of evaluating detergents, to give results comparable to those obtained in practice.

The objective of this research has been to develop simple methods for such evaluation and for use by detergent manufacturers in improving formulations.

Dairy Sanitisers Project.—The long-term objective is to be able to recommend standards for dairy sanitisers to the S.A.A. The newly appointed officer has therefore carried out *inter alia* an extensive review of the literature.

Incidence of staphylocci in dairy products is causing concern. Initially the sanitising of factory workers' hands is being studied.

Increasing numbers of refrigerated bulk vats are being installed on dairy farms. A project to evaluate a relatively cheap, fully automatic clean in-place system for these vats has been undertaken. Progress results are encouraging. Expanded trials, and further developments in co-operation with the manufacturer, are needed as yet.

WAGGA AGRICULTURAL COLLEGE

The Diploma Course

Student Numbers.—In 1967 the College commenced its 19th academic year with 133 students. In second term a repeat Second Year student entered into residence, increasing the total to 134 students. The 134 included six repeating First Year, five repeating Second Year and one repeating Third Year.

The following table for the past 5 years compare the inter-year distributions of students.

	1964	1965	1966	1967	1968
First Year	54	55	64	63	47
Second Year	32	41	34	45	45
Third Year	33	30	35	26	43
Totals	119	126	133	134	135

In 1968 forty-two new students were enrolled into First Year giving, with five repeat students, a class of 47; the lowest total for 5 years. If the First Year failure rate is consistent with that of recent years, a small Second Year and a fairly large First Year may be foreshadowed for 1969. In this event there will be unfortunate imbalance between the 3 years.

Examinations.—Of the 26 Diploma candidates at the 1967 Third Year Final examinations, 20 passed immediately. Four succeeded in deferred examinations. The 2 others failed outright and are repeating Third Year in 1968. No student achieved honours standard.

Of the 45 Second Year students, 1 withdrew at the start of third term. Of the 44 examined at the end of the year, 26 succeeded immediately. Two failed outright and 16 were granted deferred examinations. Of the latter, 15 passed and 1 failed. One student is repeating Second Year, in 1968.

Of the 63 First Year students, 5 withdrew during second term and another came to the College at the start of third term as a repeat student. The net effect was that 59 students were examined at the end of the year. Of these, 36 passed. Six failed outright. Seventeen were granted deferred examinations and 9 of these succeeded. Five of the failures are repeating First Year, in 1968.

Curriculum and Staffing.—No significant change in subject matter or depth of treatment occurred.

The College again drew upon the field staff of Southern Agrciultural Region, for an officer to lecture and demonstrate in Apiculture to First Year students. The college was indebted also to Wagga Wagga Technical College for student instruction in Woolclassing, Welding, Surveying, Building Construction, Farm Mechanics, Farm Engineering, and Tractor Maintenance; also to Wagga Wagga High School for student instruction in English Expression and to Murrumbidgee Distrtict Ambulance Brigade for instruction in First Aid.

New Buildings and Equipment.—Early in 1967–68 financial year, the School of Farm Engineering was completed and immediately in use. In February, 1968, the almost completed tiered-seating lecture theatres (two) in the extensions to the Graham Block were put into use and are highly satisfactory. In early April, 1968, the new Library and three new offices, upstairs in the Graham Block extensions, were also occupied. Also in April, 1968, the new Lecture/Conference/Examination Hall was handed over. The 1968 Diploma Day Ceremony was conducted there.

Student's Practical Training.—Reduction of the duration of practical work, as mentioned in last year's report, has been further considered. It has been decided that as from 1968 the required extra-mural training will be 8 weeks. First Year extra-mural work will not be credited though it will be encouraged. The 8-weeks commitment is to be done in vacation periods between first term in Second Year and the start of third term in Third Year, except that at least 2 of the weeks must be during the Third Year.

The College acknowledges indebtedness to the many private farmers who have given willing and unreserved co-operation for whole-farm studies, in farm management and general operation, during student tours, and those who have provided valuable practical experience for students during vacations.

Senior students gained further experience, as stock attendants and in judging competitions, at the Sydney Royal Show and the Wagga Wagga Show.

Student Tours.—Third Year students made the annual 5-days tour of the central slopes, southern tablelands and coastal region early in October, 1967. Instead of the usual 4-days tour of the Batlow, Tumbarumba, and Tumut area, 1-day tours to these places were conducted this year. This was because of accommodation problems due to the high total of students in the Third Year. Half-day or 1-day visits were made also to local and distrtict studs, and to properties for Farm Management Surveys and valuation exercises. Two 1-day tours, of the Coleambally and Murrumbidgee Irrigation Areas, were undertaken by the Third Year students.

Students' Extra Curricular Activities.—Sporting activities were again prominent. The College cricket first XI completed the 1967–68 season without defeat. Five football teams were entered in the Riverina Rugby Football Competition. Basketball and table tennis teams were also entered in local competitions. The first boxing tournament for a number of years was held this year.

Wagga participated in the 1967 Agricultural Colleges Sports Association contests at Gatton, Queensland.

Other activities included: debating within the College and in the city; community service in a refuse clean-up of a section of the Wagga/Coolamon highway; and assistance with local civic authorities in bush fire control.

Ex-students.—The total of ex-students is now 616, as follows:

W.D.A:	403,	including 35 Honours Diplomates
H.D.A.:	8,	including 3 Honours Diplomates
H.D.A. (Hort.):	4,	including 1 Honours Diplomate
	415,	including 39 Honours Diplomates
Non Diplomates:	201	
Total:	616	

Short-term Schools and Conferences

A Farm Management/Economics school was conducted at the College by the Division of Marketing and Agricultural Economics. Thirty-seven farmers and graziers attended. The 16th Annual Turkey Raisers Conference and School was attended by 33 delegates. The 16th Annual Rural Youth School, in Sheep Husbandry, was attended by 24 members from clubs all over New South Wales.

Personnel Section conducted a Departmental Staff Reporting School at the College for selected personnel, and also an Induction School for 63 University and College trainees recruited in 1968.

The College Library

In March, 1968, the library was moved into new permanent quarters in the Graham Block extensions, fitted with new steel shelving and wooden furniture and with considerable room for expansion.

College Farm and Livestock Sections

Farm.—The drought conditions prevailing for the greater part of the year seriously reduced farm production. Cereal grain production was the lowest for the past decade. Yield average for 128 acres of wheat was only 12 bushels/acre, for 57 acres of oats only 11 bushels/acre, and for 58 acres of barley only 9.5 bushels/acre.

Restrictions on pumping water from the Murrumbidgee River limited irrigation to the use of only 155 acre-feet of water, but it was possible to spray irrigate 35 acres of lucerne during the November to April period. This area produced 6.7 tons of lucerne hay per acre and enabled summer dairy production to be maintained. It also supplied valuable green feed for other farm stock.

Works and improvements included a new farm machinery shed 116 ft by 30 ft, to cover farming plant and machinery; a 20,000-gallon concrete tank added to the College water storage; and preparations to construct ten more tanks to add 240,000 gallons capacity.

Horse Section.—At 31st May, 1968, there were 52 head (5 entires, 29 mares, seven geldings and 11 foals), compared to 55 a year earlier. Sales included 3 colts at an average of $533, to return $1,600, and 2 mares at an average of $500, to return $1,000. Transfers comprised 4 geldings and one mare to Trangie Agricultural Research Station and 1 gelding to Centennial Park. Service of private mares comprised 19 original and 2 free return services, yielding $760 for service and $158 for agistment. At the 1968 Sydney Royal Show, exhibits from the Horse Stud gained the awards of Best Arab Exhibit, Champion Stallion, and three First, one Second, one Third and one Fourth prize.

Beef Cattle Section.—At 31st May, 1968, there were 75 head in the Stud (15 bulls, 60 cows) as against 77 (10 bulls and 67 cows) a year earlier. There were also 14 grade animals (10 steers, 4 cows). Sales included a stud bull, for $400.

Sheep Section.—Work is progressing to complete the sheep yards at the irrigation section, and the ram shed. Stock numbers, depleted during the drought, should return to normal by April, 1969. College sheep gained two Firsts, one Second and one Third prize from seven entries in the 1967 Wagga Show.

Dairy Section.—Production in this drought year was naturally much lower than in the preceding 12 months when the College herd was the highest producing Jersey herd in N.S.W. for milk and second from highest for butterfat. This year 38 Jerseys completed lactation with a production average of 7,870 lb milk, 5.0 per cent B.F.; 388 lb B.F./cow.

Sales of dairy Stud stock included 11 bulls, for $1,625; 6 females for $260; and 8 bobby calves, for $60. In addition, 13 animals were culled to the College Commercial Herd, and 2 in-calf Jersey heifers were transferred to Hawkesbury Agricultural College for demonstrations. Sales of milk, cream and butterfat returned $9,537. Further, 7,000 gallons whole milk was used at the College kitchen.

College dairy cattle were shown at the Wagga Show and Sydney Royal Show. The College Jerseys won all four interbreed classes at the Wagga Show.

Piggery Section.—There were 128 head at 30th June, 1968, compared to 119 a year earlier. During the year 228 were killed for food, 18 were sold to market and 3 for stud use. Demand for stud pigs declined.

YANCO AGRICULTURAL COLLEGE AND RESEARCH STATION

The Farm Certificate Course

For this 1-year Course 102 students were enrolled in 1967 and 70 gained the Certificate. Arrangements are in hand to build another 50 student rooms, as well as a commercial-type piggery and poultry section.

Three ex-students of the College are currently undergraduates in the School of Agriculture, University of Sydney, and three are in the Diploma Course at Hawkesbury Agricultural College. One graduated from the Wagga Agricultural College in 1967.

Research and General Activities

The research activities will have been incorporated in the reports of the various Divisions/Branches of the Department responsible for the respective project at the Station. Although the 17 months drought in this area was not broken until the very good rains of April, May, June, 1968, and although the worst dust storms in 20 years were experienced this year, the Station was able to continue every research project to which the facilities were committed. Some highlights for special mention here are as follows.

Two new rockmelon varieties, Yanco Treat and Yanco Delight, each of excellent quality and each resistant to Powdery Mildew and *Fusarium* wilt, have been supplied to the seed trade for seed increase and general release.

The College Guernsey herd again won the William Newcombe Memorial Prize, for the highest producing team of six cows. The cows averaged 635 lb butterfat for 300 days.

Rice Research Agronomist Mr D. J. McDonald is currently in the U.S.A. for post-graduate studies, holding the D. Mackellar Memorial Scholarship awarded by the Rice Industry.

The Annual Field Day of the Station was attended by some 350 rice growers; 25 per cent of the total of rice growers.

R. M. WATTS, Director-General.

APPENDIX I

The Accounts of the Department of Agriculture

The cost of maintaining the Department of Agriculture is met from the Consolidated Revenue Fund, and the capital expenditure on buildings and permanent improvements to Departmentally-owned property is met from the General Loan Account. In addition to the foregoing classifications of expenditure, the Department is assisted in financing certain specified lines of research and development together with the control of insect pests and animal diseases by levies on industry and by grants from the Commonwealth, semi-governmental and public and private organizations. Operations falling into this category are reflected in a large number of accounts within the general Treasury classification of "Special Deposits Account", some details of which are given later in this Appendix.

COMPARATIVE STATEMENT OF EXPENDITURE

Account	1966–67	1967–68	Increase or Decrease
	$	$	$
Consolidated Revenue Fund	13,863,339.89	14,884,267.32	1,020,927.43 (Increase)
General Loan Account	334,498.97	472,347.06	137,848.09 (Increase)
	14,197,838.86	15,356,614.38	1,158,775.52 (Increase)

EXPENDITURE FROM CONSOLIDATED REVENUE FUND

The following tabulation is a comparison of the expenditures from Consolidated Revenue Fund by the functional Divisions of the Department for the last two financial years:

Division	1966-67	1967-68	Increase or Decrease
	$	$	$
Central Administration	2,826,322.60	2,864,318.11	37,995.51 (Inc.)
Science Services	576,472.43	632,849.92	56,377.49 (Inc.)
Plant Industry	737,916.64	726,446.34	10,470.30 (Dec.)
Horticulture	677,886.98	769,357.03	91,470.05 (Inc.)
Dairying	1,241,299.60	1,450,980.70 (*b*)	209,681.10 (Inc.)
Hawkesbury Agricultural College	642,968.30	681,598.76	38,630.46 (Inc.)
Wagga Agricultual College	394,704.03	423,692.92	28,988.89 (Inc.)
Research Stations	1,355,531.78	1,483,786.27	128,254.49 (Inc.)
Animal Industry—			
Head and District Offices	2,403,844.82	2,654,209.34	250,364.52 (Inc.)
Queensland Border	249,581.63	265,107.62	15,525.99 (Inc.)
Tick Quarantine Areas	2,250,627.31	2,429,924.58	179,297.27 (Inc.)
Royal Botanic Gardens	506,183.77	501,995.73	4,188.04 (Dec.)
	13,863,339.89	14,884,267.32 (*a*)	1,020,927.43 (Inc.)

(a) Includes Drought Relief measures:

	$
Transport costs of fodder to primary producers in the Western Division	2,709.21
Subsidy on transport of stock for re-stocking	101,294.30
Transport costs of stock to and from agistment	31,064.90
	$135,068.41
(b) Includes assistance to North Coast Dairying Industry	746,150.00
	$881,218.41

The amount of $746,150 for Assistance to the North Coast Dairying Industry was carried to Special Deposits Account (No. 99)—"North Coast Dairy Feed Year Assistance Scheme"—comment on which appears later in this Appendix under that section dealing with Special Deposits Account.

EXPENDITURE FROM GENERAL LOAN ACCOUNT

Expenditure from the General Loan Account for the year was $472,347.06.

Details of the expenditure of $472,347.06 are as under:

	$
Advanced Education—	
Capital works financed from State and Commonwealth allocations—State contribution	64,000.00
Wagga Agricultural Research Institute—	
Agronomy Barn	7,654.91
Division of Science Services—	
Rydalmere—Plant Quarantine Station	9,000.00
Hawkesbury Agricultural College—	
School of Dairy Technology—New Research Laboratory	67,488.44
Dareton Horticultural Research Station—	
Additional Offices (including District Office Accommodation)	15,381.65
Extensions and Irrigation Drainage	10,051.18
Narrabri Agricultural Research Station—	
Plant Breeder's Shed (Cotton)	39,577.62
Wollongbar Agricultural Research Station—	
Acquisition of Land	147.00
District Veterinary Laboratory (Far North Coast)	146,938.03
Yanco Agricultural College and Research Station—	
Establishment of Farm Certificate Course	199.79
Glenfield Veterinary Research Station—	
Armidale Veterinary Diagnostic Centre	1,100.00
Laboratories and Conference Room	87,868.44
Steam Raising Plant and Autoclaves	22,940.00
Total Expenditure	$472,347.06

OTHER ACCOUNTS

Special Deposits Accounts

The following is a complete list of accounts and funds within the Special Deposits Account at the Treasury on which this Department operates:

Name of Account	Balance as at 1st July, 1967	Receipts 1967-68	Payments 1967-68	Balance as at 30th June, 1968
	$ Cr.	$	$	$ Cr.
Advances to Officers for purchase of Motor Cars	Dr. 220,260.32	118,702.11	133,638.74	Dr. 235,196.95
Potato Growers' Licensing Act, 1940	633.41	2,860.74	2,675.00	819.15
Commonwealth/State Flood Relief Scheme, 1964	50,035.34	....	....	50,035.34
Advanced Education—Capital Works financed from State and Commonwealth Allocations	....	83,800.00	28,706.40	55,093.60
Balance of Salaries Adjustment Suspense Account	232,607.09	280,084.88	232,607.09	280,084.88
Commonwealth State Flood Relief Scheme, 1967	100,000.00	120,112.75	83,747.49	136,365.26
Government Printing Office—Working Account and Stores Account and Sale of Publications	....	3,637.18	214.40	3,422.78
North Coast Dairy Feed Year Assistance Scheme	299,821.05	746,150.00	843,107.60	202,863.45
Noxious Insects Destruction Account	23,770.01	163,085.63	121,650.96	65,204.68
Swine Compensation Fund	488,764.44	134,815.44	18,009.48	605,570.40
Commonwealth Grant—State Secondary School and Technical Training Projects financed under States' Grants (Technical Training) Act—1965-68	52,536.55	436,000.00	362,924.66	125,611.89
Hawkesbury Agricultural College Canning Factory Account	5,181.71	2,081.35	3,210.34	4,052.72
Bush Fire and Flood Relief Account (State)	51,637.31	....	1,850.00	49,787.31
Hawkesbury Agricultural College—Dairying Factory Working Account	64,975.42	422,190.96	406,770.64	80,395.74
Tobacco Industry Trust Account	15,167.60	21,943.64	23,902.81	13,208.43
Pasture Control Account	20,082.74	....	....	20,082.74
Commonwealth Government grant for acquisition of Library Materials in terms of the States' Grants (Advanced Education) Act, 1967	....	60.00	....	60.00
French Bean Seed Marketing Board of New South Wales—Funds upon Dissolution Account	524.99	....	408.88	116.11
Potato Marketing Board of New South Wales—Funds upon Dissolution Account	1,078.76	39.81	886.00	232.57
Unclaimed Moneys Account	2,119.48	1,644.68	2,431.40	1,332.76
Commonwealth Extension Services Grant	87,035.65	699,089.42	635,798.11	150,326.96
Cattle Compensation Fund	1,775,926.25	325,352.39	335,153.46	1,766,125.18
V.P. Bragg Scholarship—Wagga Agricultural College	530.47	615.00	880.30	265.17
Wagga Agricultural College Swimming Pool Account	757.26	2,095.44	1,535.70	1,281.00
Wheat Industry Stabilisation Fund (Disposal) for Research and Extension in the Wheat Industry	15,992.67	63,906.25	58,415.57	21,483.35
V.P. Bragg Scholarship Account (Investment)	12,000.00	....	....	12,000.00
Wheat Industry Stabilisation Fund (Disposal) for Research and Extension in the Wheat Industry—Investment Account	90,000.00	....	60,000.00	30,000.00
Additional Poultry Housing for Random Sample Tests at Hawkesbury Agricultural College	Dr. 1,270.48	1,270.48	....	....
Plague Locust Control	....	40,000.00	40,000.00	....
Poll on question of Constitution of a Citrus Fruits (excluding Lemons) Marketing Board for the Shire of Wentworth and portion of the Shire of Balranald	Dr. 124.83	147.32	22.49	....
Triennial Elections—Egg Marketing Board of the State of New South Wales—1967	....	1,183.80	1,183.80	....
Triennial Elections—Rice Marketing Board for the State of New South Wales	....	139.33	139.33	....
Triennial Elections—Tobacco Leaf Marketing Board of New South Wales—1968	....	....	34.08	Dr. 34.08
Tuberculosis Eradication Programme	Dr. 171.10	171.10	....	....
Apple and Pear Spray Residue Committee—Employment of Fruit Inspector	300.00	80.00	363.37	16.63
Australian Dairy Produce Board—Grant for Research Projects—				
Composition of Milk	250.09	....	....	250.09
Efficiency of Detergents	662.70	....	33.00	629.70
Expansion of other Pasture and Animal Research	Dr. 975.19	23,754.66	17,758.11	5,021.36
Expansion of Pasture Species Research	1,296.73	19,499.72	13,970.94	6,825.51
Flood Irrigation Research, Mooneba	469.94	391.86	114.25	747.55
Milking Machines and Mastitis	166.60	....	....	166.60
Pasture Improvement	Dr. 1,756.24	5,750.00	3,379.76	614.00
Problems associated with the manufacture and keeping qualities of Process Cheese	971.49	1,324.71	1,487.69	808.51
Recombining Unit—Hawkesbury Agricultural College	7,141.52	5,000.00	9,655.34	2,486.18
Socio-economic Investigations	1,523.04	7,829.78	8,601.98	750.84
The influence of Seasonal Variations in the Compositional Quality of Skim Milk on the Physical and Chemical Qualities of Spray Dried Skim Milk Powder	2,993.71	6,514.19	8,203.26	1,304.64

Special Deposits Account—*continued*

Name of Account	Balance as at 1st July, 1967	Receipts 1967-68	Payments 1967-68	Balance as at 30th June, 1968
	$ *Cr.*	$	$	$ *Cr.*
Australian Meat Research Committee—				
Upper River Beef Feed Year Research—North Coast	6,003.72	21,875.28	23,492.96	4,386.04
Major and Minor Element Deficiencies in Soil from Beef Areas	697.77	3,227.65	3,487.39	438.03
Phosphate Levels in North Coast Soils with specific relation to Summer Legumes	2,237.96	12,276.61	11,271.74	3,242.83
Pasture intake and Digestibility Studies—Production of more Beef per acre on Irrigated Pastures	2,468.38	....	2,468.38	....
Winter Nutrition on Northern Tablelands	2,141.19	4,257.97	5,785.25	613.91
Nature and Organization of the Australian Beef Cattle Industry	*Dr.* 202.67	7,128.51	5,861.09	1,064.75
Beef Cattle Improvement through Breeding Methods	383.12	5,936.39	6,040.47	279.04
Inoculants for Summer Legumes	1,144.06	....	1,143.86	0.20
Incidence, Importance and Control of Parasites of Cattle in New South Wales	*Dr.* 42.83	10,681.91	8,368.97	2,270.11
Epidemiology and Control of Fluke Parasites of Cattle in New South Wales	3,551.80	....	3,551.80	....
Bloat Research	1,499.82	4,000.00	5,302.75	197.07
Sheep Fertility Service	....	26,000.00	4,894.36	21,105.64
Regional Economic Studies on Mutton and Lamb Production	....	2,000.00	829.98	1,170.02
Australian Potash Research Institute Grant—				
Investigation into Potassium Status of New South Wales Soils	395.62	....	295.00	100.62
Australian Wool Board Grants—				
Adaptive Pasture Research—Southern Tablelands	*Dr.* 7,004.73	19,192.74	10,684.96	1,503.05
A Developmental Project for the High Rainfall Region of South-Eastern Australia	908.38	4,231.00	4,527.92	611.46
Aerial Control of Serrated Tussock—Southern Tablelands	558.51	2,943.00	2,115.97	1,385.54
Aerial Sowing of Pastures	936.11	5,307.00	5,576.90	666.21
A Study of Factors Limiting Pasture Yield	467.42	5,504.00	5,215.35	756.07
A Study of some Factors Influencing Efficiency of Root Nodule Bacteria	97.32	5,695.00	6,507.72	*Dr.* 715.40
Comparison of Management Systems	*Dr.* 86.09	3,387.00	4,129.64	*Dr.* 828.73
Comparison of the Lifetime Performance of Single and Twin Born Merino Ewes	324.67	1,799.00	1,791.38	332.29
Co-operative Research into Treatment of non-Arable Areas—Serrated Tussock Control	546.86	759.00	810.29	495.57
Economic Investigation of Serrated Tussock Control	4,830.88	58.32	....	4,889.20
Effect of Pasture Management and time of Lambing on Wool and Lamb Production in the South-West Wheat Belt of New South Wales	*Dr.* 2,912.87	5,157.00	1,366.50	877.63
Efficiency of Wool Production	*Dr.* 658.69	7,287.00	6,624.51	3.80
Fleece Measurement for selection of Stud Merino Rams	*Dr.* 6,181.32	20,540.00	14,085.58	273.10
Fleece Measurement for selection of Stud Merino Rams—*Fees*	454.35	2,366.62	....	2,820.97
Forage Ecology—Research Agronomists training with Division of Plant Industry, CSIRO, Canberra	1,214.00	7,065.00	3,273.27	5,005.73
Investigation of Black Soil Scarab	2,537.12	50.00	....	2,587.12
Investigation of vital statistics of Yass Valley Merino Flocks	618.43	7,881.00	5,510.15	2,989.28
Physiology of Pasture Seeds	827.26	4,828.00	4,470.78	1,184.48
Post-Graduate Scholarship—M. H. Campbell	....	1,471.00	1,471.00	....
Post-Graduate Scholarship—B. A. Hamilton	....	1,400.00	1,400.00	....
Post-Graduate Scholarship—G. E. Robards	....	1,200.00	1,200.00	....
Research into control of Insecticidal Resistance in Sheep Blowfly	1,949.59	4,000.00	7,074.68	*Dr.* 1,125.09
Scholarship—P. D. Claxton	....	236.44	236.44	....
Scholarship—R. E. Everett	....	2,974.66	2,974.06	0.60
Scholarship—I. D. Killeen	....	1,925.00	1,814.00	111.00
Scholarship—R. J. Roughley	....	2,745.00	2,650.00	95.00
Scholarship—A. J. Williams	1,682.00	2,400.00	4,082.00	....
Sheep Breeding and Pasture Management—Relative Efficiency at several stocking rates and superphosphate levels	4,255.36	13,130.00	14,558.76	2,826.60
Skin Folds and Ram Fertility	330.77	....	44.27	286.50
The Importance of the Ram in Flock Reproductive Performance	478.29	5,612.00	1,871.31	4,218.98
The Influence of Rates of Stocking and Superphosphate Applications on the Productivity of Merino Ewes grazing improved annual pastures	546.13	320.00	201.31	664.82
The Productivity of Natural Annual Pastures at Trangie with and without Supplementary Areas of Lucerne or Natural Perennial Grasses	*Dr.* 4,250.93	4,910.00	122.86	536.21

Special Deposits Account—*continued*

Name of Account	Balance as at 1st July, 1967	Receipts 1967-68	Payments 1967-68	Balance as at 30th June, 1968
	$	$	$	$
Banana Research Committee Grant for Research—	*Cr.*			*Cr.*
Mixed Ripe Problem	54.44	395.56	372.70	77.30
Packaging	*Dr.* 38.35	238.35	13.30	186.70
Handling	128.89	....	4.60	124.29
Ripening	327.57	....	....	327.57
Transport	....	900.00	148.63	751.37
Pre-cooling	139.02	....	....	139.02
Consumer preference Survey, Sydney	....	1,000.00	....	1,000.00
Staff and Travelling	2,319.20	1,531.18	2,523.68	1,326.70
Board of Tick Control Employees' proportion of Contributions to Local Government Superannuation Scheme	11,888.54	38,890.31	39,228.59	11,550.26
Brown Rot Investigations—Trust Fund	654.65	....	43.84	610.81
Commonwealth contribution towards cost of Investigation into Excess Spray Residue on Fruit	2,014.48	11,100.00	11,351.07	1,763.41
Commonwealth Grant—Milking Machine Components Testing Station	158.86	2,961.00	1,995.72	1,124.14
Contribution by Australian Wool Board—Training of Livestock Research Officers	72.56	....	3.51	69.05
Contributions by Industry towards Overseas visit—R. J. Jessup	....	3,000.00	1,600.00	1,400.00
Contributions by Industry towards Research into Meat Meal Quality at Seven Hills Poultry Research Station	358.78	....	292.96	65.82
Contribution by Metropolitan Water, Sewerage and Drainage Board towards maintenance of Greens, Embankments, etc.—Woollahra and Centennial Park Reservoirs	610.61	....	610.61	....
Contributions by States towards Salary and Expenses of Patrol Officer, Grasshopper Control	6,896.72	3,699.00	4,510.24	6,085.48
Contributions to Animal Insect Pest Investigations—Glenfield Veterinary Research Station	470.26	....	110.41	359.85
Contribution towards Development of Tamworth Experiment Station	1,350.23	....	....	1,350.23
Contributions towards establishment of Library at Agricultural Research Institute, Wagga	16.62	....	16.62	....
Contribution towards publication of an Australian Bibliography of Agricultural Economics	5,100.00	....	5,100.00	....
Department of Agriculture Suspense Account	54,995.68	5,006,536.22	4,964,090.81	97,441.09
Donation by I.C.I.A.N.Z. towards Pasture Fertilizer Nitrogen Investigations	493.35	....	487.00	6.35
Geigy Agricultural Chemicals contribution towards Weedicide Research Project at Hawkesbury Agricultural College	200.00	....	....	200.00
Grant by Australian Apple and Pear Board for Co-operative Programme with CSIRO on Pest Management in Pome Fruit Orchards	1,952.02	4,147.98	4,525.50	1,574.50
Grant by Australian Honey Board for Hive Equipment for Departmental Apiaries (operating expenses)	983.60	500.00	976.88	506.72
Grant by Australian Honey Board for Post-Graduate Training—G. L. G. Lee—Travel in U.S.A.	800.00	....	800.00	....
Grant by Co-operative Bud Selection Society, Limited, towards Establishment of Citrus Mother Tree Block	....	500.00	478.17	21.83
Hawkesbury Agricultural College—Egg Laying Competition Prize Fund	1,441,37	2,126.10	1,553.19	2,014.28
Hawkesbury Agricultural College Trust Account	10,961.96	20,283.73	24,242.39	7,003.30
Legume Inoculant Association contribution towards Research and Service in the field of Rhiziobiology	5.45	....	5.45	....
McGarvie Smith Institute contribution towards Facilities for Glenfield Veterinary Research Station	624.25	....	621.77	2.48
Manning District Agricultural Research Council contribution for Pasture Research in the Manning District	652.57	1,000.00	1,211.19	441.38
Overseas Visit—G. R. Gregory	33.60	....	33.60	....
Overseas Visit—N. C. Lloyd—Contribution from New South Wales Apple and Pear Growers' Association	1,200.00	....	1,200.00	....
Pender, W. S. Memorial Fund—Interest on Bonds	337.49	118.00	120.00	335.49
Purchase of Peat Cultures for U-DALS	....	150.00	50.33	99.67
Reserve Bank of Australia Grant from Rural Credits Development Fund for Dairy Farm Development on Alluvial and Chocolate Basalt Soils in Richmond Valley	1,307.17	....	167.15	1,140.02
Reserve Bank of Australia Grant from Rural Credits Development Fund towards Whole Farm Feed Year Studies on Red Basalt Soils	1,118.89	....	94.59	1,024.30
Rice Research Laboratory, Yanco	45.00	....	45.00	....
Shannon Vale Nutrition Station Working Account	36,666.56	12,987.94	11,641.89	38,012.61
Skeleton Weed Research—Grant by Technical sub-Committee for Salary of Technical Assistant	....	1,600.00	....	1,600.00

Special Deposits Account—*continued*

Name of Account	Balance as at 1st July, 1967	Receipts 1967-68	Payments 1967-68	Balance as at 30th June, 1968
	$ *Cr.*	$	$	$ *Cr.*
South Coast Agricultural Research and Extension Council Contribution towards Research	....	2,500.00	1,573.07	926.93
The Sulphur Institution of U.S.A. Grant for Compilation, etc., of results of the U.P.S.E.T. Trials	1,590.70	....	....	1,590.70
Tobacco Extension Grant to finance additional Extension Work	1,866.99	....	1,402.92	464.07
Tropical Fruit Research Station—Donation by Banana Growers' Federation	4,228.47	....	....	4,228.47
Unclaimed Salaries and Wages	873.21	3,062.25	2,459.69	1,475.77
Unemployment Relief in Drought Areas, 1968	....	15,000.00	7,229.95	7,770.05
Wagga Agricultural College Trust Account	6,138.93	5,149.36	6,797.31	4,490.98
Wheat Industry Research Committee of New South Wales Grants—				
Breeding of Improved Wheat Varieties for Irrigation Areas	36.80	10,600.00	3,633.69	7,003.11
Contribution of Legumes to the Productivity of Wheat Soils in Northern New South Wales	217.01	4,700.00	4,196.78	720.33
Controlled Environment Chamber for Frost Research	398.59	....	189.87	208.72
Expanded Wheat Research Projects—Wagga Agricultural Research Institution—Agronomic Survey	*Dr.* 2,170.15	2,559.11	388.96	....
Extensions—Laboratories—Agricultural Research Institute, Wagga	10,000.00	....	....	10,000.00
Genetic Analysis of Physiological Components of Maturity of Wheat	1,717.63	2,200.00	1,018.47	2,899.16
Glasshouse for Cytogenetic Investigations	4,984.00	....	4,984.00	....
Growth, Development and Yield of Wheat Varieties in Relation to date of Sowing and Environment	995.89	16,000.00	459.07	16,536.82
Investigation of Black Soil Scarab	505.48	....	94.59	410.89
Laboratory Equipment—Wagga Agricultural Research Institute	568.40	....	427.11	141.29
Machinability of Doughs	176.00	....	176.00	....
Purchase of Solarimeter	104.20	....	....	104.20
Skeleton Weed Research	1,630.89	400.00	1,792.56	238.33
Soft Wheat Quality Programme—Central West	2,430.03	....	56.36	2,373.67
Soil Fertility	*Dr.* 27.23	634.25	67.36	539.66
Travel and Capital Expenditure—Dr A. T. Pugsley and G. M. Halloran	431.38	....	....	431.38
Wheat Breeding—Temora	400.00	....	....	400.00
Wheat Frost Research—Overseas Travel—W. V. Single	....	261.68	261.68	....
Wheat Research in the Central West	2,056.44	64,194.00	48,009.93	18,240.51
Wheat Industry Research Council Grants—				
Australian National Wheat Variety Collection	....	26,500.00	....	26,500.00
Capital Grant for Extensions—Agricultural Research Institute, Wagga	8,150.34	....	....	8,150.34
Controlled Environment Facilities	....	10,500.00	....	10,500.00
Critical Levels of Soil Nitrogen in the Southern Wheat Belt	1,201.90	6,532.01	7,117.89	616.02
Economics of Segregation and Storage of Wheat	1,156.89	4,500.00	4,992.97	663.92
Growth Analysis of Wheat in relation to Development and the Natural Environment	1,722.24	3,520.10	4,655.75	586.59
Importation of Norwegian Drill and Austrian Autoheader	....	8,000.00	1,572.97	6,427.03
Improvement of Durum Wheat Varieties	1,042.70	7,692.30	7,803.76	931.24
Improvement of Grazing Lucerne Varieties for Wheat Belt Soils and testing of Phalaris Strains	....	12,000.00	63.35	11,936.65
Investigation into Possibilities of Segregation of Wheats on the basis of Quality—Wheat Grading Survey	1,698.58	....	....	1,698.58
Investigation of Varietal Differences in the Major Components of Baking Quality	254.00	....	254.00	....
Laboratory Equipment—Agricultural Research Institute, Wagga	....	3,000.00	255.64	2,744.36
Manufacture of new Cereal Plot Header	965.88	1,823.62	2,600.00	189.50
Overseas Visit—H. Marcellos	....	2,500.00	695.00	1,805.00
Overseas Visit—A. N. Smith	658.11	....	....	658.11
Pathology Glasshouse	....	12,000.00	....	12,000.00
Seed Counter for Durum Project	550.00	550.00	....	1,100.00
Senior Post-Graduate Scholarship in Agricultural Extension—R. D. Macadam	....	1,950.00	....	1,950.00
The Chemistry of Soil Nitrogen in relation to Wheat Production	1,200.00	1,900.00	3,063.24	36.76
The use of first generation hybrid seed for Commercial Wheat Production	398.70	3,191.00	2,930.12	659.58
Wheat Frost Injury—Biochemistry of Resistance Mechanisms	946.63	5,750.00	4,779.68	1,916.95
Wheat Frost Research—Overseas Travel, W. V. Single	748.64	....	748.64	....
Yellow Dwarf Virus	160.98	....	0.24	160.74
Yanco Agricultural Research Station Trust Account	8,385.28	5,873.45	4,197.29	10,061.44
Total $	3,419,879.19	9,343,756.22	8,873,879.34	3,889,756.07

Commonwealth Grant for State Secondary Schools—Technical Training Projects

This grant has been made by the Commonwealth under its States' Grants (Technical Training) legislation. It is a three year plan, involving a total expenditure of $800,000 on technical training facilities.

The 1967–68 financial year was the final year of the first triennium and the table hereunder shows the accounting for the grant to 30th June, 1968:

	$	$	$
1965–66—			
Receipts	200,000.00		
Expenditure		103,258.98	
1966–67—			
Receipts	164,000.00		
Expenditure		208,204.47	
	364,000.00	311,463.45	
Balance carried forward			52,536.55
1967–68—			
Receipts			436,000.00
Total available funds for 1967–68			$488,536.55
Expenditure—			
Buildings—			
Hawkesbury Agricultural College—			
Science Block Renovations	109,122.54		
Animal Husbandry Unit	18,076.00		
		127,198.54	
Wagga Agricultural College—			
Estensions to Graham Block	193,978.81		
Engineering and Farm Machinery Demonstration Unit	33,073.98		
		227,052.79	
Yanco Agricultural College and Research Station—			
Metal and Farm Building Instruction Workshop		10.50	
Total Cost of Buildings		354,261.83	
Equipment—			
Hawkesbury Agricultural College	8,709.58		
Wagga Agricultural College	46.75 *Cr.*		
Total Cost of Equipment		8,662.83	
Total Expenditure			362,924.66
Balance carried forward			$125,611.89

The balance carried forward is committed for completion of works in progress.

Commonwealth Grants for Colleges of Advanced Education

Commonwealth legislation provides for grants towards capital expenditure on projects for courses of instruction which comply with certain criteria laid down. The first triennium for these grants terminates on 31st December, 1969.

Only one course at Hawkesbury Agricultural College currently complies with the requirements. However, both Hawkesbury and Wagga Agricultural Colleges are expected to qualify for grants of this nature from 1st January, 1970, when the second triennium might be expected to commence. In the meantime, and in anticipation of both Colleges meeting the criteria by 1st January, 1970, a programme of capital works, totalling $1,422,000, has been put in hand with a view to completion by that date. The programme is being financed on a $1 for $1 basis by the Commonwealth and the General Loan Account of the State.

The table hereunder sets out particulars of expenditure during the 1967–68 financial year:

	$	$	$
Buildings—			
Hawkesbury Agricultural College—			
Erection of Poultry Section	2,542.70		
Laboratory and Lecture Room for Dairy Technology	8,055.82		
		10,598.52	
Wagga Agricultural College—			
Extensions to Dining Room and Kitchen	33.00		
Machinery Shed	8,554.18		
Sports Facilities (Groundsmen's Shed)	3,200.00		
		11,787.18	
Total Expenditure on Buildings			22,385.70
Other Projects—			
Wagga Agricultural College—			
Development Plan	920.70		
Roads	5,400.00		
			6,320·70
Total Expenditure to 30th June, 1968			$28,706.40

Swine Compensation Fund

The regulations under the Swine Compensation Act, 1928, were amended to provide for an increased maximum market value of pigs for the purposes of the Act to operate from 7th July, 1968. Under this amendment the values were varied as follows:

Stud Pigs—increased from $40 to $100 per pig.

Pigs other than Stud Pigs—increased from $20 to $50 per pig.

The Swine Compensation (Taxation) Act, 1961, was also amended to provide for a reduction from 20 cents to 10 cents for every entry relating to the delivery of a pig for slaughter as required by Section 2 of the Act. The variation was effective from 1st January, 1968.

A summary of the operations on the fund is set out hereunder:

	$
Balance as at 1st July, 1967	488,764.44
Receipts—Stamp Duty	134,815.44
	$623,579.88
Payments—Swine Compensation	18,009.48
Balance as at 30th June, 1968	$605,570.40

Cattle Compensation Fund

	$	$	$
Balance as at 1st July, 1967			1,775,926.25
Add Receipts—			
Levy		191,574.17	
Stamp Duty		133,778.22	
			325,352.39
			2,101,278.64
Deduct Payments—			
Compensation		312,471.39	
Administrative Costs—			
Legal	11.65		
Allowances to Secretaries of Pastures Protection Boards	7,989.00		
Department of Agriculture	14,681.42		
		22,682.07	
			335,153.46
Balance as at 30th June, 1968			$1,766,125.18

The following statistical information is furnished in connection with the payment of compensation amounting to $312,471.39

Disease	Claims			Animals			Payments		
	Reg 5	Reg 6	Total	Reg 5	Reg 6	Total	Reg 5	Reg 6	Total
							$	$	$
Tuberculosis	469	210	679	1,065	319	1,384	45,215.75	25,198.27	70,414.02
Cancer	3,422	256	3,678	4,477	291	4,768	135,164.48	17,164.69	152,329.17
Actinomycosis	2,034	5	2,039	2,323	5	2,328	70,179.57	316.52	70,496.09
Actinobacillosis	522	2	524	679	2	681	17,570.95	92.35	17,663.30
Pleuro pneumonia contagiosa	4	..	4	6	..	6	538.00	..	538.00
Trichomoniasis	..	..	..	..	..	..	..	..	..
Tick Fever	10	..	10	13	..	13	851.61	..	851.61
Johne's Disease	2	..	2	2	..	2	179.20	..	179.20
Total	6,463	473	6,936	8,565	617	9,182	269,699.56	42,771.83	312,471.39

Commonwealth Extension Services Grant

As stated in the Annual Report for 1966–67, the Commonwealth grants for extension have been amalgamated in the year under review (1967–68) into one grant, known as the Commonwealth Extension Services Grant. The final accounting under the two earlier grants, i.e., Commonwealth Dairy Industry Extension Grant and Commonwealth Grant for Expansion of Agricultural Advisory Services appeared in the Annual Report for 1966–67.

The first allocation under the Commonwealth Extension Services Grant was made in 1966–67 and there is an assurance that such grants will continue for five years, i.e., to 1971–72. The amount made available for 1967–68 was $752,100.

Expenditure since the commencement of the new grant on 1st July, 1966, is set out below:

Item	1966–67	1967–68	Total
	$	$	$
Research Officers	3,861.61	37,810.06	41,671.67
Extension Officers	106.42	121,576.47	121,682.89
Field Assistants	....	98,682.94	98,682.94
Inspectors and Laboratory Assistants	833.49	37,386.09	38,219.58
Equipment for Officers	24,817.25	57,048.83	81,866.08
Motor Vehicles	4,719.55	32,334.56	37,054.11
Buildings	28,525.00	30,810.04	59,335.04
Material for Demonstrations	212.68	12,409.34	12,622.02
Extension Aids	11,786.37	22,604.59	34,390.96
Publications and Books	12,123.25	41,575.18	53,698.43
Conferences, Training and Visits	28,566.08	66,942.02	95,508.10
Herd Recording	....	76,617.99	76,617.99
	$115,551.70	$635,798.11	$751,349.81

Noxious Insects Destruction Account

The Noxious Insects Act, 1934, provides, inter alia, for striking a levy under specified conditions. Moneys received from the levy are paid into Special Deposits Account and applied by the Minister for the purposes of the Act.

The 1967–68 Statement of Receipts and Payments is as under:

Receipts	$	Payments	$
Balance as at 1st July, 1967	23,770.01	Insecticides	75,314.79
Levies	163,085.63	Materials and Sundry Purchases	1,554.67
		Helicopter and Aircraft Hire	904.50
		Aerial Spraying	580.00
		Contribution to Australian Locust Patrol Service	3,297.00
		Repayment Treasury Advance	40,000.00
		Balance as at 30th June, 1968	65,204.68
	$186,855.64		$186,855.64

Potato Growers' Licensing Act, 1940 (as amended)

Transactions on this Account for 1967–68 were:

Receipts	$	Payments	$
Balance as at 1st July, 1967	633.41	Grants to Potato Growers' Association	2,675.00
Licence Fees	2,860.74	Balance as at 30th June, 1968	819.15
	$3,494.15		$3,494.15

Shannon Vale Nutrition Station—Working Account

The following is the Statement of Receipts and Payments for the year ended 30th June, 1968:

RECEIPTS	$	PAYMENTS	$
Balance as at 1st July, 1967	36,666.56	Wages	5,329.43
Sales of Wool	11,295.71	Shearing	1,053.58
Sale of Sheep and Sheep Skins	1,588.48	Motor Fuel	220.89
Rental of Cottage	103.75	Vaccines and Drenches	619.16
		Fodder	1,108.16
		Workers' Compensation Insurance	104.18
		Payroll Tax	115.43
		Freight and Cartage	442.41
		Equipment	825.21
		Plant Repairs	213.53
		General Supplies	1,609.91
		Balance as at 30th June, 1968	38,012.61
	$49,654.50		$49,654.50

STATEMENT OF RECEIPTS—CONSOLIDATED REVENUE FUND—FINANCIAL YEAR 1967–68

Head of Receipt	Net Receipts	
Receipts for Services Rendered—	$	$
Agricultural Colleges and Farms—		
Rents	63,434.24	
Students' Fees	163,997.92	
		227,432.16
Fees—		
Public Officers—Jurors	33.40	
Examination Fees	75.30	
Witness' Expenses	39.33	
Apiary Registration	4,803.67	
Grading—Dairy Industry Act	20.87	
Registration—Dairy Industry Act	126.00	
Dairy Science Schools	1,267.00	
Farm Produce Agents' Act, 1926-1932	594.00	
Fertilizer Act—1934	1,667.60	
Pest Destroyers Act, 1945	3,628.70	
Registration of Stock Brands	5,886.58	
Registration of Swine Brands	480.33	
Stock Foods and Medicines Act, 1940	7,993.92	
Veterinary Surgeons' Act, 1923	3,172.40	
		29,789.10
Contributions—		
Commonwealth Government—Administration of Plant Quarantine	205,014.86	
Commonwealth Government—Administration of Animal Quarantine	94,369.42	
Commonwealth Government—Administration of Commerce Act	84,934.39	
Commonwealth Government—Maintenance of Gardens at Admiralty House	15,781.58	
		400,100.25
Miscellaneous Services Rendered—		
Plant Diseases Act—Inspection and Fumigation Fees	1,060.31	
Meat Industry Act—Meat Inspection Fees	756,827.40	
Commonwealth Scientific and Industrial Research Organisation—Subsidy—Vegetable Growing at Hawkesbury Agricultural College	1,000.00	
Herd Recording Fees	157,639.90	
Seed Testing and Certification Fees	21,900.63	
Administration of Cattle Compensation Fund	14,681.42	
Commission for Collection of Premiums	5,044.49	
Other Miscellaneous Receipts	57,933.11	
		1,016,087.26
Total—Receipts for Services Rendered		$1,673,408.77
General Miscellaneous Receipts—		
Rents exclusive of Land	8,488.00	
Fines and Forfeitures	15,300.44	
Sale of Farm produce	329,239.76	
Sale of Government Property	8,636.85	
Commonwealth Government—Contribution for Cattle Tick Control	288,000.00	
Repayment to credit of Consolidated Revenue Fund—Previous Years	155,360.90	
Miscellaneous Receipts on account of Interest	63.52	
Transfers of Part Balances not required	167.62	
Broadcasting Fees	72.00	
Gas and Electricity	8,966.40	
Postages	125.08	
Telephone Calls (Private)	3,694.61	
3 per cent Contribution—Pastures Protection Boards	56,339.22	
Employer's Liability to State Superannuation Fund	3,494.95	
Commonwealth Grant towards cost of Herd Recording	71,200.00	
Other Miscellaneous Receipts	1,556.66	
Total—General Miscellaneous Receipts		950,706.01
Grand Total—All Revenue		$2,624,114.78

MISCELLANEOUS ACCOUNTS

Veterinary Surgeons' Act—No. 25 of 1923 (as amended)

The Act provides for the establishment of the "Board of Veterinary Surgeons of New South Wales". Fees and penalties collected under the Act are paid to the credit of Consolidated Revenue Fund, from which the administrative expenses of the Board are met.

As at 30th June, 1968, there were 687 registered Veterinary Surgeons.

Hereunder is the Statement of Receipts and Payments for the year ended 30th June, 1968:

Receipts	$	Payments	$
Registration Fees	197.25	Salaries	1,699.00
Roll Fees	2,908.09	Members' Fees	428.40
Restoration Fees	67.06	Travelling Expenses	34.85
		Postal Expenses	77.07
		Printing	507.88
		Excess of Receipts over Payments	425.20
	$3,172.40		$3,172.40

Meat Inspection Service

The Meat Inspection Service is administered by virtue of the Meat Industry Act, 1915 (as amended) which Act makes provision for a scale of inspection fees. There was no variation to the fees during 1967–68.

The following table is a Statement of Receipts and Payments in connection with the service for the year ended 30th June, 1968:

Receipts	$	Payments	$
Inspection Fees—		Salaries and Wages	885,513.58
Regulation No. 7	401,010.80	Temporary Assistance	11,949.81
Regulation No. 8	69,630.40	Allowances	321.98
Regulation No. 9	201,585.95	Retirement Leave	4,292.03
Section No. 9B	36,443.65	Metropolitan Meat Industry Board Endowment Fund Contribution	5,711.54
Regulation No. 10	48,156.60	Rent	1,661.94
		Travelling Expenses	47,047.02
		Motor Vehicle Running Costs	486.49
		Freight and Cartage	154.53
		Books and Periodicals	128.47
		Postal and Telephone Services	1,254.08
		Fees for Services Rendered	220.00
		General Stores	12,761.28
		Gas and Electricity	25.44
		Printing	315.99
		Microtome	393.00
Excess of Payments over Receipts	215,895.98	Siro-Keen Lapping Plate	486.20
	$972,723.38		$972,723.38

In addition to the deficiency of $215,895.98 shown above, overhead expenses amounting to $179,492.68 should be taken into account. These include employer's superannuation contribution, workers' compensation insurance and payroll tax, calculated at 20 per cent of the cost of salaries and wages ($897,463.39). This amount increases the deficiency to $395,388.66.

Fund Created by the Wheat Marketing (Barring of Claims) Act, No. 22 of 1929 (as amended)

REVENUE ACCOUNT FOR THE YEAR ENDED 30TH JUNE, 1968

	$		$
To Commitment Provisions	4,986.18	By Interest on Investments (including Savings Bank Interest)	4,986.18
	$4,986.18		$4,986.18

BALANCE SHEET AS AT 30TH JUNE, 1968

Liabilities	$	$	Assets	$
Accumulated Funds—			Investments in Government Securities (Face Value)	93,600.00
Balances as at 1st July, 1967	101,652.93		Commonwealth Savings Bank	11,895.15
Commitment underspent	281.22		Interest accrued	980.18
		101,934.15		
Commitment		4,541,18		
		$106,475.33		$106,475.53

Dairy Products Factory—Hawkesbury Agricultural College

The operations of the Dairy Products Factory for the financial year 1967–68 resulted in a loss of $27,449.64.

Abridged accounts are set out hereunder:

MANUFACTURING AND TRADING ACCOUNT, FOR THE YEAR ENDED 30TH JUNE, 1968

	$		$
Stock on hand at 1st July, 1967	18,383.21	Sales	360,534.70
Purchases	279,134.60	Stock on hand at 30th June, 1968	10,641.27
Repairs and Maintenance	7,935.39		
Fuel, Light and Power	6,109.41		
Water	2,980.61		
Salaries and Wages	24,258.28		
Workers' Compensation Insurance Premiums	357.27		
Payroll Tax	604.39		
Superannuation—Employer's Liability	2,419.87		
Depreciation	25,838.14		
Sundry Expenditure	474.75		
	$368,495.92		
Gross Profit	2,680.05		
	$371,175.97		$371,175.97

PROFIT AND LOSS ACCOUNT FOR THE YEAR ENDED 30TH JUNE, 1968

	$		$
Salaries and Wages	7,874.85	Gross Profit from Manufacturing and Trading Account	2,680.05
Payroll Tax	196.20	Sundry Income	238.53
Workers' Compensation Insurance Premium	115.98	Net Loss	27,449.64
Superannuation—Employer's Liability	331.44		
Levies—Butter and Cheese	1,104.97		
Printing and Stationery	91.03		
Freight and Cartage	499.27		
Laboratory Expenses	299.41		
Repairs and Maintenance	184.35		
Telephone	300.38		
Depreciation	1,529.91		
General Expenses	114.74		
Interest on Capital	17,725.69		
	$30,368.22		$30,368.22

APPROPRIATION ACCOUNT FOR THE YEAR ENDED 30TH JUNE, 1968

	$		$
Net Loss 1967-68	27,449.64	Balance as at 1st July, 1967	28,704.81
Balance as at 30th June, 1968	23,442.95	Expenditure not met from Working Account	22,020.64
		Adjustment on Milk Cartons	167.14
	$50,892.59		$50,892.59

APPENDIX II

Published Matter*, 1967-68

*Viz.:—Matter printed as Department of Agriculture (D. of A.) booklets, or contributed to and printed as articles either in Department of Agriculture journals (the monthly *Agricultural Gazette of N.S.W.*, quarterly *Review of Marketing and Agricultural Economics*, bi-monthly *Dairy Topics*, monthly *Poultry Notes*, biannual *Veterinary Notes*, the periodical *Research and the Farmer*) or the journals of other institutions/organizations; and papers published in the proceedings of technical conferences.

The Appendix does not list the many times greater volume of items contributed in the course of extension work through such channels as the Department's weekly printed *Press Copy*, and the Regional/District publicity releases for newspapers and radio stations. Indications of the volume of this published matter are included in this report under "Division of Information Services" and Division of Extension Services".

RESEARCH STATIONS BRANCH

D. of A. Booklets

Carlin, C. T. (1967)—Pullers for repair jobs. Bulletin 74.

Holligan, P. J. and Drever, J. G. (1967)—Developments in electric fencing. Bulletin 73.

Contribution to Journals

Anon. (1968)—Check P.T.O. capacity for irrigation pumping. Rural Newsletter-Central Coast Research and Extension Committee 16.

Anon. (1967)—Classification system for agricultural tractors. Ag. Gaz. N.S.W. 78 (8): 462.

Anon. (1968)—Pumping with tractors. Ag. Gaz. N.S.W. 79 (1): 20.

Anon. (1967)—Rural accidents must be reported. Ag. Gaz. N.S.W. 78 (11): 664.

Anon. (1967)—Scrap metal danger to stock and machinery. Ag. Gaz. N.S.W. 78 (10): 603.

Carlin, C. T. (1967)—In the farm workshop-pullers for repair jobs. Ag. Gaz. N.S.W. 78 (10): 567–569.

Drever, J. G. (1967)—The farm tractor. Rural Newsletter-Central Coast Research and Extension Committee 9.

Drever, J. G. (1967)—A guide to buying and using augers. Ag. Gaz. N.S.W. 78 (7): 394–400.

Drever, J. G. (1967)—Prolonged tyre life. Rural Newsletter-Central Coast Research and Extension Committee 10.

Finlayson, W. H. (1967)—Designing systems for bulk handling of fruit for canning. Ag. Gaz. N.S.W. 78 (7): 370–376.

Finlayson, W. H. (1968)—Diesel tractor operational problems. Farmers Newsletter—Irrigation Research and Extension Committee 99.

Holligan, P. J. (1968)—Maintenance of orchard sprayers. Rural Newsletter—Central Coast Research and Extension Committee 15.

Holligan, P. J. (1967)—Oscillating booms. Rural Newsletter—Central Coast Research and Extension Committee 13.

Whiston, W. D. (1967)—Count down to harvest. Ag. Gaz. N.S.W. 78 (8): 465.

DIVISION OF PLANT INDUSTRY

D. of A. Booklets

Anon. (1968)—Broad-leaf paspalum: a new paspalum for the North Coast. Bulletin P362.

Anon. (1967)—Cabbage culture. Bulletin P14.

Anon. (1967)—Cotton in New South Wales and Australia. Bulletin P325.

Anon. (1967)—Dodder: serious parasitic weed. Bulletin P259.

Anon. (1967)—Growing watermelons. Bulletin P48.

Anon. (1968)—High seeding rates with nitrogen application to grazing oats pay dividends at Trundle. Bulletin P358.

Anon. (1967) (1968)—Home production of vegetables. Bulletin P50.

Anon. (1967)—Marrows and squashes. Bulletin P25.

Anon. (1967)—Rhubarb growing. Bulletin P278.

Anon. (1968)—Run your own pasture trials. Bulletin P365.

Anon. (1968)—Weed control in wheat. Bulletin P364.

Anon. (1968)—Wheat as a stock fodder. Bulletin P361.

Bowmaker, E. W. (1967)—Principles of irrigation. Bulletin P336.

Boyle, J. W. (1967)—Irrigated maize—inland areas. Bulletin P332.

Brown, C. Walkden (1968)—The Kurrajong. Bulletin P230.

Brown, C. W. (1968)—An outline of the wheat growing industry in N.S.W. Bulletin P54.

Brown, C. W. and Fitzsimons, R. (1968)—Oat varieties for 1968. Bulletin P323.

Campbell, M. H. (1968)—Procedure for aerial spraying of serrated tussock. Bulletin P363.

Crofts, F. C. (1968)—More winter feed and drought reserves from high density nitrogen fertilized oats. Bulletin P338.

Darley, E. C. (1967)—Drought tests: pasture species in the Moree district. Bulletin P354.

Gidley, V. N. (1967)—Pasture grasses for the New England tablelands. Bulletin P357.

Green, K. R. (1968)—Killing woody plants with hormone herbicides. Bulletin P231.

Green, K. R. (1968)—Spiny burr grass. Bulletin P252.

Grimmet, S. G., Holligan, P. J. and Drever, J. G. (1967)—Strip grazing and the electric fence. Bulletin P349.

Jessup, J. E. and Wallin, D. E. (1967)—Pastures and fodder crops for the Murrumbidgee and Coleambally irrigation areas and associated districts. Bulletin P248.

Launders, T. E. (1968)—Piper—a new sudan grass that rivals hybrid forages for grazing. Bulletin P369.

Macindoe, S. L. and Brown, C. W. (1968)—Wheat-breeding and varieties in Australia. Bulletin P76.

Mead, K. I. and Blunt, R. W. (1967)—Crop rotations for the Northern Tablelands: a summary of 36 years of experiments. Bulletin P210.

Mengersen, F. (1968)—Coolabah: a new dual purpose oat for the central and southern districts. Bulletin P360.

Mengersen, F. and Fitzsimmons, R. W. (1968)—Identification of oat varieties in N.S.W. Bulletin P79.

Noonan, J. B. (1968)—Fodder cane: a valuable fodder crop for the North Coast. Bulletin P127.

Rylands, P. F. (1967)—Plan first, spray later. Bulletin P353.

Simpson, P. (1967)—Lucerne in the Central Tablelands. Bulletin P355.

Spencer, R. T. (1967)—Cauliflower growing. Bulletin P20.

Spencer, R. T. (1967)—Cucumber growing with special reference to the early crop. Bulletin P21.

Wietschi, P. A. (1967)—The yield of irrigated summer forage crops. Bulletin P352.

Wilson, G. P. and Murtagh, G. J. (1968)—Lablab bean: annual forage crops for the North Coast. Bulletin P232.

Woodward, H. A. (1968)—Production of registered cereal seed. Bulletin 359.

Contribution to Journals

Ballard, J. H. (1967)—Dry farming in areas of low rainfall. Information Bulletin on the Near East wheat and barley improvement and production project, F.A.O., vol. IV, No. 2.

Boerema, E. (1967)—Placement of nitrogen fertilizer for rice in Southern Australia. International Rice Commission Newsletter, *XVI* (3).

Boerema, E. and McDonald, D. J. (1967)—Evaluation of sowing methods for establishing rice in Southern Australia. International Rice Commission Newsletter, *XVI* (3).

Boyle, A. J. (1967)—Deep ploughing overcomes a problem. Ag. Gaz. N.S.W. 78 (12): 703–707.

Boyle, A. J. (1968)—Control of tobacco mosaic virus in tobacco. Ag. Gaz. N.S.W. 79 (2): 90–94.

Boyle, A. J., Sjostedt, J. P., Freer, R. E. and Cargill, C. F. (1967)—Wheat as a stock fodder. Ag. Gaz. N.SW. 78 (11): 655–662.

Brooks, D. R. (1968)—Townsville lucerne—a low cost improvement for beef areas of the Clarence Valley. Ag. Gaz. N.S.W. 79 (4): 199–201.

Brown, C. W. (1967)—Wheat round the world, Ag. Gaz. N.S.W. 78 (8): 459–462.

Cook, Betty E. and McMaster, G. (1968)—The distribution of *phalaris tuberosa* in N.S.W. Ag. Gaz. N.S.W. 78 (10): 589–591.

Dann, P. (1968)—The effect of mowing of defoliated stems on regrowth of a first-year lucerne stand. Journal of Aus. Inst. of Ag. Sc. 34 (1)–Technical note.

Darley, E. C. (1968)—Wheat—cultural practices in the Moree district. Ag. Gaz. N.S.W. 79 (6): 343–348.

Fishpool, K. I. (1968)—Temporary electric fence. Ag. Gaz. 79 (6): 361–363.

Fishpool, K. I. and May, E. S. (1967)—High seedling rates with nitrogen application to grazing oats pay dividends at Trundle. Ag. Gaz. N.S.W. 78 (11): 637–641.

Fitzimmons, R. W. (1967)—Frost damage and diseases in cereal crops, 1966–67. Ag. Gaz. N.S.W. 78 (9): 498–503.

Fitzimmons, R. W. and Brown, C. W. (1968)—Wheat varieties for 1968. Ag. Gaz. N.S.W. 79 (1): 2–8.

Freebairn, R. (1968)—Nitrogen fertilizers for cereals in the North West. Ag. Gaz. N.S.W. 79 (5): 264–267.

Gidley, V. N. (1967)—Find that article. Ag. Gaz. N.S.W. 78 (12): 735–737.

Gottl, R. and Conroy, R. J. (1967)—Verticillium wilt of tomatoes. Ag. Gaz. N.S.W. 78 (9): 504–506.

Grimmett, S. G. (1967)—The effect of severity of defoliation and nitrogen fertilizer on the growth of *phalaris tuberosa L.* Journal of Br. Grassland Soc. 2 (1).

Launders, T. (1968)—Don't miss irrigated subterranean clover for the north coast. Ag. Gaz. N.S.W. 79 (3): 143–146.

Leggett, E. K. (1967)—Broadleaf paspalum—a new paspalum for the north coast. Ag. Gaz. N.S.W. 78 (12): 690–693.

Macadam, R. D. (1968)—Manning district dairy farmer makes money with oats and nitrogen. Ag. Gaz. N.S.W. 79 (2): 80–85.

Macadam, R. D. (1968)—Vetch crops profitable in the Manning District. Ag. Gaz. N.S.W. 79 (2): 101–104.

Macadam, R. D. and Noonan, J. B. (1968)—Lucerne growing in the Manning District. Ag. Gaz. N.S.W. 79 (4): 223–228

Mears, A. D. (1968)—Herbicides in use. Ag. Gaz. N.S.W. 79 (6): 352–355.

Mears, A. D. (1968)—Saffron thistle and its control. Ag. Gaz. N.S.W. 79 (6): 370–372.

Mears, A. D. (1968)—Trouble in wild oat control. Ag. Gaz. N.S.W. 79 (4): 194–197.

Mears, A. D. (1968)—Weed control in wheat. Ag. Gaz. N.S.W. 79 (2): 66–71.

Mears, P. T. (1967)—The significance of the Amnemus weevil in tropical legume-based pastures. Journal of Aust. Inst. of Ag. Sci. 33 (4).

Moraghen, B. J., Hesketh, J., and Low, A. (1968)—Effects of temperature and photoperiod on floral initiation among strains of cotton. Cotton Growing Review.

Murtagh, G. J. and Dougherty, A. B. (1968)—Relative yields of lablab and velvet bean. Tropical grassland 2, (1).

Noonan, J. B. (1968)—Firm seed beds—better sowing strikes. Dairy topics, vol. 13 (2).

Noonan, J. B. (1968)—Sod seeding pastures and fodder crops. Dairy topics, vol. 13 (3).

O'Brien, A. D. (1968)—Run your pasture trials. Ag. Gaz. N.S.W. 79 (2): 86–89.

Paull, R. and Evans, G. (1967)—Incidence and distribution of verticillium wilt in cotton crops of the Namoi Valley. Book note: Journal of Aust. Inst. of Ag. Sci. 33 (3).

Robinson, G. G. and Simpson, I. H. (1967)—Topdressed native pastures can be highly productive. Ag. Gaz. N.S.W. 78 (8): 440–443.

Robinson, G. G. and Simpson, I. H. (1968)—Drought feeding at Shannon Vale. Ag. Gaz. N.S.W. 79 (2): 78–79.

Sumeghy, J. B. and Kirton, N. C. (1967)—Varieties of tomatoes for mechanical harvesting on the Murrumbidgee Irrigation Area of N.S.W. Aust. Jnl Exp. Agric. and Anim. Husb. 7 (27).

Swain, D. J. (1967)—Controlling barnyard grass in rice. Ag. Gaz. N.S.W. 78 (8): 473–475.

Woodward, H. A. and Smith, A. N. (1968)—Care needed in the use of new concentrated fertilizers. Ag. Gaz. N.S.W. 79 (3): 150–151.

DIVISION OF HORTICULTURE

D. of A. Booklets

Anon. (1967)—Cherry growing. Bulletin H39.

Anon. (1968)—Cool storage of pears. Bulletin H148.

Anon. (1967)—Early apricots: selecting, growing, marketing. Bulletin H38.

Anon. (1968)—Pecan nut culture. Bulletin H114.

Cann, H. J. (1967)—Establishing a banana plantation. Bulletin H126.

Cann, H. J.—Insect pests and diseases of bananas. Bulletin H178.

Cann, H. J. (1968)—The Macadamia nut. Bulletin H61.

Fuller, E. J.—The essentials of successful tomato marketing. Bulletin H181.

Gregory, G. R. (1967)—Pruning grapevines in the home garden. Bulletin H92.

Gregory, G. R. (1967)—Grape growing. Bulletin H156.

Holbeche, J. A., Cox, J. E., and Austen, V. C. (1967)—Strawberry culture. Bulletin H131.

Levitt, E. C. (1967)—Heavy drop of citrus fruits. Bulletin H46.

Scott, K. J. (1968)—Market quality of pome fruits. Bulletin H183.

Whittaker, E. C. (1967)—Pear growing. Bulletin H51.

Contributions to Journals

Anon. (1967)—Breakdown of apples in cool store related to weight loss. Ag. Gaz. N.S.W. 78 (7): 418.

Anon. (1967)—New post-harvest treatments reduce wastage in bananas during marketing. Ag. Gaz. N.S.W. 78 (10): 605–607.

Anon. (1967)—Depth and spacing of tile drains in horticultural plantings. Ag. Gaz. N.S.W. 78 (11): 682.

Anon. (1968)—Ethylene absorbent increases storage life of bananas packed in polyethylene bags. Ag. Gaz. N.S.W. 79 (1): 52.

Anon. (1968)—Puffing and creasing of oranges—effect of gibberellic acid. Ag. Gaz. N.S.W. 79 (2): 112.

Anon. (1968)—Micro propagation of bananas. Ag. Gaz. N.S.W. 79 (4): 235–236.

Anon. (1968)—Post-harvest control of brown rot in peaches with Thiabendazole. Ag. Gaz. N.S.W. 79 (4): 236.

Edgerton, D. J., and Greenhalgh, W. J. (1968)—Absorption; translocation and accumulation of labelled N-dimethylaminosuccinamic acid in apple tissues. Proc. Am. Soc. Hort. Sci. 91: 25–30.

Fuller, E. J. (1968)—Advice to apple and pear packers. Ag. Gaz. N.S.W. 79 (2): 95–100.

Fuller, E. J. (1967)—The essentials of successful tomato marketing. Ag. Gaz. N.S.W. 78 (10): 585–588.

Fuller, E. J. (1967)—Packing mandarines. Ag. Gaz. N.S.W. 78 (10): 596–597.

Gane, W. B., and Clark, B. (1968)—Neglected fruit trees —menace to the fruit industry. Ag. Gaz N.S.W. 79 (6): 373–374.

Greenhalgh, W. J. (1967)—The effect of growth retarding and growth promoting substances on flower bud formation in cultures of the apple *Malus sylvestris, Mill.* Ph. D. Thesis, Cornell University.

Greenhalgh, W. J., and Edgerton, L. J. (1968)—Interaction of alar and gibberellin on growth and flowering of the apple. Proc. Am. Soc. Hort. Sci. 91: 9–17.

Johnson, J. F. (1968)—Deep ripping assists orchard establishment. Ag. Gaz N.S.W. 79 (5): 268–270.

Johnson, J. F. (1968)—Fruit growing in the Orange district. Ag. Gaz. N.S.W. 79 (3): 169–174.

Leigh, D. S., and Sproule, R. S. (1967)—When hail hits bananas. Ag. Gaz. N.S.W. 78 (11): 652–654.

Malcolm, H. D. R. (1968)—Canning peach varieties recommended for the Murrumbidgee Irrigation Areas. Ag. Gaz. N.S.W. 79 (2): 108–111.

Mort, C. H. (1968)—A prune planting survey in the Young district. Ag. Gaz. N.S.W. 79 (5): 287–292.

Scott, K. J. (1968)—Market quality of pome fruits. Ag. Gaz. N.S.W. 79 (2): 72–77.

Scott, K. J., and Roberts, E. A. (1968)—The importance of weight loss in reducing breakdown of Jonathan apples. Aust. Journal Exp. Ag. An. Husb. 8 (32): 377–380.

Seberry, J. A., Leggo, D., and Kiely, T. B. (1967)—Effect of skin coatings on development of black spot in stored Valencia oranges. Aust. Journal Exp. Ag. An. Husb. 7 (29): 593–600.

Contributions to Technical Conferences

Greenhalgh, W. J. (1967)—The use of growth substances in horticultural production. Symposium on New Concepts in the use of fertilizers and growth substances in crop and pasture production. Aust. Inst. Agr. Sci. (N.S.W. Branch).

Greenhalgh, W. J. (1968)—Effect of growth retardant alar on flowering and fruit set in the apple. Aust. Fruit Res. Conf. —Working Papers: 235–236.

Leigh, D. S. (1967)—Weeds in horticultural crops. Proc. Weed Soc. N.S.W. 1: 4–1/4–2.

Mort, C. H. (1968)—Recent introductions of stone fruits into N.S.W. Aust. Fruit Res. Conf.—Working Papers: 260–262.

Smart, R. E. (1968)—A model of the photosynthetically active radiation environment of a vineyard. Aust. Fruit Res. Conf.—Working Papers: 11–12.

Smart, R. E. (1968)—A new root observation chamber. Aust. Fruit Res. Conf.—Working Papers: 137–138.

Sproule, R. S., and Stannard, M. C. (1968)—Gibberellic acid, PSPA, and bunch trimming effects on sultana grapes. Aust. Fruit Res. Conf.—Working Papers: 217–219.

Turkington, C. R. (1968)—Effect of cyclocel and alar on fruit set, yield, and growth of Gordo Blanco grape vines. Aust. Fruit Res. Conf.—Working Papers: 47–53.

Turner, D. W. (1968)—Banana leaf growth and climatic factors. Aust. Fruit Res. Conf.—Working Papers: 124–125.

Turner, D. W. (1968)—Fruit tree nutrition—a review. Aust. Fruit Res. Conf.—Working Papers 47–53.

Turner, D. W. (1968)—Growth of banana bunches under sub-tropical conditions. Aust. Fruit Res. Conf.—Working Papers: 179–180.

Turner, D. W. (1968)—Nutrient uptake and climatic effects in bananas. Aust. Fruit Res. Conf.—Working Papers: 87–88.

Turner, D. W., and Barkus, B. (1968)—Sampling for banana leaf analysis. Aust. Fruit Res. Conf.—Working Papers: 80–81.

DIVISION OF ANIMAL INDUSTRY

Contributions to Journals

Batterham, E. S. (1968)—Variation in measurements of nitrogen balance and feed digestibility with pigs. Proc. 7th Biennial Conf. Aust. Soc. Anim. Prod. 89.

Bayfield, R. F., Barrett, J. D., and Falk, R. H. (1967)—Determination of lipids in biological materials by paper chromatography. J. Chromatog. 28: 363–70.

Bayfield, R. F., and Cole, E. R. (Univ. N.S.W.) (1966)—Rapid Paper Chromotographic Separation of Phenothiazine and its Photometric Determination. Chemist-Analyst 55: 107.

Bayfield, R. F., Falk, R. H., and Barrett, J. D. (1968)—The separation and determination of—tocopherol and carotenoids in serum or plasma by paper chromatography. J. Chromatog. 36: 54.

Beeby, L. D. (1968)—Lot feeding of beef cattle—its prospects in Australia. Ag. Gaz. N.S.W. 79 (3): 137–42.

Beeby, L. D. (1968)—Market considerations and feed components in lot feeding of beef cattle. Ag. Gaz. N.S.W. 79 (5): 258–63.

Beeby, L. D. (1968)—Types of budgets in beef cattle feed lots. Ag. Gaz N.S.W. 79 (6): 322–8.

Benecke, F. S. (1967)—Introducing queen bees. Ag. Gaz. N.S.W. 78 (9): 513–6.

Benecke, F. S. (1967)—Nosema disease of honey bees. Ag. Gaz. N.S.W. 79 (5): 274–9.

Bennett, N. W. (1968)—When to shear—before mating or before lambing. Ag. Gaz. N.S.W. 79 (3): 134–6.

Bonner, R. B. (1968)—Mycolic dermatitis—the cause of lumpy wool. Ag. Gaz. N.S.W. 79 (5): 298–302.

Bootes, B. W. (1967)—Survey shows weakness in mastitis control. Ag. Gaz. N.S.W. 78 (8): 476–8.

Bourke, M. E. (1967)—The food conversion efficiency in lambs of two crosses of sheep. Aust. J. Exp. Agric. and Anim. Husb. 7: 199–202.

Bourke, M. E. (1967)—A study of mating behaviour of Merino rams. Aust. J. Exp. Agric. and Anim. Husb. 7: 203–5.

Boyle, A. J. (Plant Industry), Sjostedt, J. P. (Dairying), Freer, R. E., and Cargill, C. F. (1967)—Wheat as a stock fodder. Ag. Gaz. N.S.W. 78 (11): 655–61.

Brunskill, A. (1968)—Birthcoat and lamb survival. Ag. Gaz. N.S.W. 79 (4): 229–230.

Brunskill, A. (1968)—Defective udders and lamb survival. Ag. Gaz. N.S.W. 79 (3): 152–153.

Charles, G. E. (1968)—Sheep disease problems associated with high density stocking. Ag. Gaz. N.S.W. 79 (5): 271–3.

Claxton, P. D. (1968)—*Brucella ovis* vaccination of rams. A comparison of two commercial vaccines and two methods of vaccination. Aust. Vt. Jnl. 44: 48–54.

Clinton, B. H. (1968)—Grazing management of lucerne. 79 (5): 282–286.

Coleman, R. L., and Holder, J. M. (1968)—The effect of stocking rate on butterfat production of dairy cows grazing kikuyu grass pastures fertilized with nitrogen. Proc. 7th Biennial Conf. Aust. Soc. Anim. Prod. 7.

Curnow, J. A. (1968)—In vitro agglutination of bovine erythrocytes infected with *Babesia argentina*. Nature, 217: (5125).

Curnow, J. A., and Curnow, Barbara A. (1967)—An indirect haemagglutination test for the diagnosis of *Babesia argentina* infection in cattle. Aust. Vt. J. 43: 286–90.

Cutts, N. A. (1967)—Design of honey houses. Ag. Gaz. N.S.W. 78 (10): 570–575.

Cutts, N. A. (1967)—Four important bee diseases. Ag. Gaz. N.S.W. 78 (12): 698–702.

Drinan, J. P., and Dun, R. B. (1967)—The association between face cover and the productivity of merino ewes in 12 N.S.W. flocks. Aust. J. Exp. Agric. and Anim. Husb. 7: 412–20.

Eastoe, R. D. (1967)—Many shearing losses can be prevented. Ag. Gaz. N.S.W. 78 (12): 715–720.

Eastoe, R. D. (1968)—Wethers on the North Coast. Ag. Gaz. N.S.W. 78 (12): 340–342.

Eastoe, R. D., and Luff, A. (1967)—Sheep yards—a selection of plans. Ag. Gaz. N.S.W. 78 (7): 378–383.

Fowler, D. G. (1967)—The effect of selection for skin fold on the fertility of Merino rams. Wool Tech. and Sheep Breed. 14: 85–7.

Fowler, D. G. (1968)—Skin folds and merino breeding 5. Variations in scrotal, testis and rectal temperatures as affected by site of measurement, acclimatization to heat and degree of skin fold. Aust. J. Exp. Agric. and Anim. Husb. 8: 125–32.

Fowler, D. G. (1968)—Skin folds and merino breeding 7. The relations of heat applied to the testis and scrotal thermoregulation to fertility in the Merino ram. Aust. J. Exp. Agric. and Anim. Husb. 8: 142–8.

Fowler, D. G., and Kennedy, J. P. (1968)—Skin folds and Merino breeding 6. The effects of varying heat exposures and degree of skin fold on rectal, scrotal and testis temperatures. Aust. J. Exp. Agric. and Anim. Husb. 8: 133–41.

Franklin, M. C., McInnes, P. A., and Briggs, P. (1967)—Maintenance of Merino sheep fed varying protein roughages with or without supplements of chopped lucerne hay and wheat. Aust. J. Exp. Agric. and An. Husb. 7: 206–12.

Freer, R. E., and Gahan, R. J. (1968)—Controlling cattle lice in beef herds—is it economic? Ag. Gaz. N.S.W. 79 (5): 308–9.

Gee, C. D. (1967)—Some effects of route of administration and dilution on the toxicity of carbon tetrachloride for sheep. Vet. Insp. 31: 80–3.

Giles, J. R. (1967)—The effects of different levels of nutrition from weaning to 17 months of age on the lifetime production of merino ewes. Aust. J. Exp. Agric. and Anim. Husb. 8: 149–57.

Godlee, A. C., and Scarlett, E. C. (1968)—Promising results from ewe lamb mating trials. Ag. Gaz. N.S.W. 79 (3): 180.

Hall, R. A. (1967)—Eradication of bovine tuberculosis and brucellosis. Vet. Insp. 31: 21–6.

Happich, F. A., Boray, J. C., and Healy, B. P. (1967)—The comparative anthelmintic efficiency of hexachlorophene, Bayer 9015, and subcataneous carbon tetrachloride in an outbreak or subacute fasciolosis in sheep. Aust. Vet. J. 43: 261–64.

Healey, J. S. (1967)—Grass tetany in cattle. Ag. Gaz. N.S.W. 78 (7): 392–3.

Healey, J. S. (1967)—Importance of sanitation in the control of the leucosis disease complex. Poultry Notes July: 3–5.

Healey, J. S. (1967–68)—Livestock health, Ag. Gaz. N.S.W. 78 (7): 407–9; 78 (8): 463–5; 78 (9): 517–9; 78 (10): 592–3; 78 (11): 666–7; 78 (12): 730–2; 79 (1): 34–5; 79 (2): 105–7; 79 (3): 175–7; 79 (4): 218–219; 79 (5): 280–1; 79 (6): 349–51.

Healey, J. S. (1968)—Necrotic enteritis—an important disease of broilers. Poultry Notes, January: 2–4.

Healey, J. S. (1968)—Water containing algae may be dangerous to stock. Ag. Gaz N.S.W. 79 (3): 157–9.

Healey, J. S., Eastoe, R. D., and Brydan, P. (1968)—Don't send daggy sheep to abattoirs. Ag. Gaz N.S.W. 79 (1): 21–4.

Healy, B. P. (1967)—Hypocalcaemia and hypomagnesaemia in breeding ewes. Ag. Gaz. N.S.W. 78 (8): 479–81.

Healy, P. J. (1968)—Colorimetric determination of serum glutamic oxalacetic-transaminase activity. Clin. Chem. Acta. 20: 165–166.

Healy, P. J. (1967)—Macrozamia poisoning. Vet. Insp. 31: 33.

Healy, P. J. (1968)—Metabolic antagonism between the analogues inositol and pinitol. Aust. J. Sci. 30 (9): 371.

Helwig, D. M., Thomas, J. H., and Williams, L. G. (1967)—The bovine enterotoxaemia complex—its aetiology, antibody responses to vaccination and problems in diagnosis. Aust. Vet. J. 43: 364–7.

Hennessy, D. W., and Ahern, C. (1968)—The intake and performance of cattle grazing irrigated pastures. Part 1: The use of steers to establish digestibility-foecal N. regressions to estimate the digestibility of grazed pastures. Aust. J. Exp. Ag. and An. Husb. 7: 391.

Henry, E. H. (1968)—T.V. branding of cattle. Ag. Gaz. N.S.W. 79 (5): 303.

Holder, J. M. (1967)—Observations on livestock production trends overseas. Vet. Insp. 31: 34–40.

Holst, P. J. (1967)—Liveweight of ewes at joining. Farmers' Newsletter, October.

Hotson, I. K. (1967)—Ostertagiosis in cattle. Aust. Vet. J. 43: 383–7.

Hughes, K. L., and Claxton, P. D. (1968)—Brucella ovis infection. (1) An evaluation of microbiological, serological and chemical methods of diagnosis in the ram. Aust. Vet. J. 44: 41–47.

Jackson, C. A. W. (1968)—Pullorum disease an important cause of chicken deaths. Ag. Gaz. N.S.W. 79 (6): 356–60.

Jackson, C. A. W. (1967)—Veterinary services and the poultry industry. Vet. Insp. 31. 29–32.

Jackson, C. A. W., Johnston, R. E., and Keast, J. C. (1968)—Progress in pullorum disease control in Australia. Aust. Vet. J. 44: 195–199.

Killeen, I. D. (1967)—The effects of body weight and level of nutrition before, during and after, on ewe fertility. Aust. J. Exp. Ag. and An. Husb. 7: 126–36.

Macadam, J. F., and Diplock, P. T. (1967)—Enterotoxaemia in sheep on dry feed. Ag. Gaz. N.S.W. 78 (12): 733–4.

McBarron, E. J. (1967)—Poisonous plants. Proc. N.S.W. Div. Aust. Vet. Ass. Gen. Meeting, 1967. 3: 41.

McBarron, E. J. (1967)—Poisonous plants and animal health. Proc. Weed. Soc. of N.S.W. 1: Section 11, 1–4.

McBarron, E. J., and McInnes, P. (1968)—Observations on urea toxicity in sheep. Aust. Vet. J. 44: 90–96.

McGuirk, B. J. (1967)—Breeding for lamb production wool tech. and sheep breed. 14: 73–5.

McGuirk, B. J., and Short, B. F. (1967)—The lustre mutation in Merino sheep. Aust. J. Exp. Agric. and Anim. Husb. 7: 296–303.

McInnes, P. A., Grainger, T. J., and Smith, M. D. (1967)—The effect of prolonged undernutrition on the recovery and reproductive performance of maiden merino ewes. Aust. J. Exp. Ag. and An. Husb. 7: 7–10.

Manglesdorf, N. W. (1968)—How important are close hocks in Merino breeding? Ag. Gaz. N.S.W. 79 (3): 147–149.

Marbach, W. (1967)—Skin diseases of horses. Ag. Gaz. N.S.W. 78 (12): 738–41.

Moore, N. W., and Holst, P. J. (1967)—The evaluation of progesterone and SC-9880 impregnated intravaginal sponges used with PMS for the induction of breeding in the anoestrous crossbred ewe. From *The control of the ovarian cycle in the sheep.* Robinson, T. J. (*ed.*), 133–143.

Mylrea, P. J. (1968)—The functioning of the digestive tract in young fasted calves. Res. Vet. Sci. 9. 1–4.

Mylrea, P. J. (1968)—Gastro-intestinal disorders and the functioning of the digestive tract of young calves. Res. Vet. Sci. 9: 14–28.

Mylrea, P. J. (1968)—Passage of antibiotics through the digestive tract of normal and scouring calves and their effect upon the bacterial flora. Res. Vet. Sci. 9: 5–13.

Nowland, W. J. (1968)—Control of foxes, rates and birds. Poultry Notes, April, 1968: 13–16.

Nowland, W. J. (1968)—Controlled environment housing of broilers. Poultry Notes, Jan., 1968: 5–13.

Pattie, W. A., and Williams, A. J. (1967)—Selection for weaning weight in Merino sheep. 3. Maintenance requirements and the efficiency of conversion of feed to wool in mature ewes. Aust. J. Exp. Ag. and An. Husb. 7: 117–125.

Plant, J. W. (1967)—Hydatid disease—a danger to human health. Ag. Gaz. N.S.W. 78 (11): 642–6.

Plant, J. W. (1967)—Suspected sodium fluoracetate poisoning in sheep and cattle. Vet. Insp. 31: 83–6.

Pym, R. A. E. (1968)—Correlations between egg weight and subsequent broiler performance as influenced by age of dam. Proc. 7th Biennial Conf. Aust. Soc. Anim. Prod. 7.

Randall, M. C. (1967)—Fourth random sample turkey test. Poultry Notes, October, 1967: 2–8.

Reis, P. J., Tink, D. A., Williams, C. B., and Williams, A. J.—A relationship between sulphur content of wool and wool production of Merino sheep. Aust. J. Biol. Sci. 20: 153–64.

Robards, G. E., and Leigh, J. H. (1967)—The effect of frequency and time of cutting on the production and quality of a barley grass (*H. leporinum*) dominant pasture. Aust. J. Exp. Ag. and An. Husb. 7: 528–32.

Robards, G. E., and Pattie, W. A. (1967)—Selection for crimp frequency in the wool of merino sheep 1. Direct response to selection. Aust. J. Exp. Ag. & An. Husb. 7: 552–58.

Robards, G. E., and Wilson, A. D. (1967)—The invitro digestibility of oesphageal fistula samples after washing for botanical separation. Aust. J. Exp. Ag. and An. Husb. 7: 22–24.

Robards, G. E., Leigh, J. H., and Mulham, W. E. (1967)—Selection of diet by sheep grazing semi-arid pastures on the Riverina Plain, 4. A grassland (*D. Causpitosa*) community. Aust. J. Exp. Ag. and An. Husb. 7: 426–33.

Roberts, B. C. (1968)—Condobolin sheep flock showed no benefit from mineral block. Ag. Gaz. N.S.W. 79 (3): 183.

Roberts, B. C. (1968)—The effect of delaying feeding of sheep. Ag. Gaz. N.S.W. 79 (4): 202–3.

Roberts, B. C. (1967)—Hot weather and merino rams. Ag. Gaz. N.S.W. 78 (10): 588.

Robinson, T. J., Moore, N. W., Holst, P. J., and Smith, J. F. (1967)—The evaluation of several progestagens administered in intra-vaginal sponges for the synchronization of aestrus in the entire cyclic Merino ewe. *From*: *The Control of the ovarian cycle in the sheep*, Robinson, T. J. (*ed.*): 76–101.

Saville, D. G. (1967)—Choline induced pyridoxine deficiency in broiler chickens. Aust. Vet. J. 43: 346–8.

Saville, D. G. (1968)—The influence of calcium on meat meal quality. Proc. 7th Biennial Conf. Aust. Soc. Anim. Prod. 7.

Shelton, J. N., Robinson, T. J., and Holst, P. J. (1967)—The evaluation of several progestagen treatments in the entire cyclic ewe. *From*: *The Control of the ovarian cycle in the sheep.* Robinson, T. J. (*ed.*): 14–38.

Simpson, I. H., and Robinson, G. G. (1968)—Increased stocking rates profitable during drought at Shannon Vale. Ag. Gaz. N.S.W. 79 (4): 220–2.

Simpson, I. H., and Robinson, G. G. (1967)—Topdressed native pastures can be highly productive. Ag. Gaz. N.S.W. 78 (8): 440–3.

Slennett, G. D. (1968)—Artificial lighting for poultry (pt 1). Poultry Notes, April, 1968: 2–8.

Slennett, G. D. (1967)—Egg quality survey. Poultry Notes, July, 1967: 11–17.

Slennett, G. D. (1967)—Feed consumption of growing pullets and layers. Poultry Notes, July, 1967: 18–19.

Slennett, G. D. (1967)—Layer nutrition. Poultry Notes, Oct., 1967: 11–12.

Slennett, G. D. (1968)—The 1967 Hawkesbury New Equipment Award. Poultry Notes, April, 1968: 9–12.

Slennett, G. D. (1967)—Some aspects of artificial insemination for poultry. Poultry Notes, October, 1967: 13–14.

Slennett, G. D. (1967)—Turkey notes. Poultry Notes, Oct., 1967: 9–10.

Smeal, M. G., Gough, P. A., Jackson, A. R., and Hotson, I. K. (1968)—The occurrence of strains of *Haemonchus contortus* resistant to thiabendazole. Aust. Vet. J. 44: 108–9.

Smith, L. M. (1968)—The protein requirements of Australian white turkeys from hatching to twelve weeks. Aust J. Exp. Ag. and An. Husb. 8: 15–20.

Smith, L. M., and Saville, D. G. (1967)—Protein quality. Poultry Notes, July: 6–10.

Tuchy, E. R. (1967)—Clover disease. Vet. Insp. 31: 87–8.

Walker, C. E. J. (1967)—Pinkeye in cattle. Vet. Insp. 31: 28–29.

Williams, L. G., Butterfield, R. M., and Dettman, E. B. (1968)—Estimation of carcass composition of beef bulls. Proc. 7th Bien. Conf. Aust. Soc. Anim. Prod. 7.

Wilson, B. R. (1968)—Performance and carcass characteristics of pigs grown along three growth curves to bacon weight. Aust. J. Agric. and Anim. Husb 8: 162–7.

Wilson, B. R. (1968)—Relationships between the weights of six individual hindquarter muscles and total muscle in pigs. Proc. 7th Bien. Conf. Aust. Soc. Anim Prod. 7.

Wilson, B. R., and Holder, J. M. (1967)—Protein quality studies No. 1. A comparison of meat and bone meal and fish meal—skim milk powder as sources of supplementary protein for growing pigs. Aust. J. Exp. Agric. and Anim. Hus. 7: 562–7.

DIVISION OF DAIRYING

D. of A. Booklets

Anon. (1968)—The dairy bull: selection, care and management. Bulletin D6.

Anon. (1968)—Preparing dairy cattle for exhibition. Bulletin D10.

Hart, C. K. (1967)—A milking bail and milk zoom for stations. Bulletin D31.

Hrdina, F. (1968)—Factors affecting percentage solids-not-fat dairy cattle. Bulletin D36.

Contributions to Journals

Armfield, L. K. (1968)—Milkstone—cause and correction. Dairy Topics. 13 (2): 15–17.

Auld, R. A. (1967)—The value of using top dairy sires. Dairy Topics. 12 (3): 17–18.

Barnett, L. (1968)—Are you Mr Jones? Dairy Topics. 13 (2): 17–18.

Barnett, L. (1968)—Good "housekeeping" in the dairy. Dairy Topics. 13 (2): 13.

Barnett, L. (1968)—Keep dairy benches and racks clean. Dairy Topics. 13 (3): 14.

Barnett, L. G. (1967)—Dairy herd breeding records. Dairy Topics, 12 (2): 14–15.

Calder, B. O. E. (1967)—Chokes improve cows' tempers. Dairy Topics. 12 (2): 12.

Crowfoot, D. W. (1967)—The dairying industry—overseas problems. Dairy Topics. 12 (3): 8–13.

Crowfoot, D. W. (1967)—International dairy congress, Munich. Dairy Topics. 12 (3): 14–16.

Crowfoot, D. W. (1967)—Overseas approach to the mastitis problem. Dairy Topics. 12 (4): 8–12.

Crowfoot, D. W. (1967)—Quality control overseas—extension and supervision. Dairy Topics. 12 (4): 12–14.

Day, D. J. (1967)—V. belts and the milking machine. Dairy Topics. 12 (5): 21–23.

Dowell, D. L. (1968)—Refrigeration will not improve milk quality. Dairy Topics. 13 (1): 19–20.

Heptonstall, D. B. (1967)—Disposing of liquid manure. Dairy Topics. 12 (5): 3–5.

Heptonstall, D. B. (1968)—Management the key for mastitis control. Dairy Topics. 13 (3): 9–12.

Hrdina, F. (1967)—Age and solids-not-fat. Dairy Topics. 12 (3): 19.

Hrdina, F. (1968)—Butterfat and S.N.F. per cent in N.S.W. dairy goat herds. Dairy Topics. 13 (2): 23.

Hrdina, F. (1968)—Butterfat levels and S.N.F. Dairy Topics. 13 (1): 16–17.

Hrdina, F. (1968)—Butterfat levels and SNF. Dairy Topics. 13 (1): 16–17.

Hrdina, F.—Effect of condition and feeding. Dairy Topics. 12 (4): 14–15.

Hrdina, F. (1968)—The effect of monthly lactation on S.N.F. Dairy Topics. 13 (3): 15.

Hrdina, F. (1967)—How milk composition changes with age and breed. Dairy Topics. 12 (5): 18–20.

Hrdina, F. (1968)—Seasonal effects on solids-not-fats. Dairy Topics. 13 (2): 12.

Hrdina, F. (1968)—Weekly gain rate of dairy heifers and effect on future milk production in cattle. Dairy Topics. 13 (3): 13.

Jeans, M. F. (1967)—How important is udder stimulation? Dairy Topics. 12 (3): 3–7.

Laffan, R. T. (1968)—How to pasteurize milk in the home. Dairy Topics. 13 (3): 16.

McLaren, E. C. (1968)—Bulk milk collection growing. Dairy Topics. 13 (1): 17.

Richardson, A. O. (1968)—Automatic cow-wash. Dairy Topics. 13 (2): 18–21.

Richardson, A. O. (1968)—Hey presto—no leg ropes. Dairy Topics. 13 (2): 21–22.

Scott, D. R. (1968)—Angle-park milking bails. Dairy Topics. 13 (1): 3–6.

Sjostedt, J. P. (1968)—New bloat control method—Hunter Valley. Dairy Topics. 13 (3): 3–7.

Sjostedt, J. P. (1967)—"Pastime"—a success story. Dairy Topics. 12 (4): 3–7.

DIVISION OF SCIENCE SERVICES

(i) BIOLOGY BRANCH

D. of A. Booklets

Conroy, R. J. (1968)—Diseases of glasshouse tomatoes. Bulletin P44: pp. 25–41.

Contributions to Journals

Anon. (1968)—Athracrose of French beans. Ag. Gaz. N.S.W. 79 (1): back cover.

Anon. (1967)—Bacterial canker of tomatoes. Ag. Gaz. N.S.W. 78 (8): back cover.

Anon. (1968)—Barley yellow dwarf virus. Ag. Gaz. N.S.W. 79 (4): back cover.

Anon. (1968)—Downy mildew of cereals and grasses—Downy mildew of oats. Ag. Gaz. N.S.W. 79 (5): back cover.

Anon. (1968)—Late blight of potato. Ag. Gaz. N.S.W. 79 (2): back cover.

Anon. (1968)—Mutations or sports in citrus. Ag. Gaz. N.S.W. 79 (4): 204–208.

Anon. (1967)—Peach leaf curl. Ag. Gaz. N.S.W. 78 (7): back cover.

Anon. (1967)—Powdery mildew of the grapevine. Ag. Gaz. N.S.W. 78 (11): back cover.

Anon. (1967)—Rust of stone fruits. Ag. Gaz. N.S.W. 78 (12): back cover.

Anon. (1968)—Sclerotinia rot. Ag. Gaz. N.S.W. 79 (3): back cover.

Anon. (1967)—Tomato spotted wilt. Ag. Gaz. N.S.W. 78 (10): back cover.

Anon. (1967)—Virus diseases of deciduous fruit trees: Apple mosaic. Ag. Gaz. N.S.W. 78 (9): back cover.

Bertus, A. L. (1968)—Downy mildew of stocks. Ag. Gaz. N.S.W. 79 (3): 178–179.

Brockwell, J., and Roughley, R. J. (1967)—An examination of the numbers of nodule bacteria associated with legume seed following commercial multiple inoculation. J. Aust. Inst. of Ag. Sci. 33 (3): 204–207.

Gottl, R., and Conroy, R. J. (1967)—Verticillium wilt of tomatoes. Ag. Gaz. N.S.W. 78 (9): 504–6.

Kable, P. F. (1967)—*Nectria penicilliodes* a new habitat. Aust. Jnl Sci. 30: 108.

Kable, P. F. (1967)—Orchard sanitation and brown rot control. Ag. Gaz. N.S.W. 78 (11): 665.

Kable, P. F. (1967)—Reaction of some pasture legumes to a species of *oidium* at Yanco, N.S.W. Ag. Gaz. N.S.W. 78 (10): 611.

Kable, P. F., and Mai, W. F. (1968)—Influence of soil moisture on *Praty-lenchus penetrans.* Nematalogica, 14: 101–122.

Kable, P. F., and Mai, W. F. (1968)—Overwintering of *Pratylenchus penetrans* in a sandy loam and a clay loam at Ithaca, New York. *Nematalogica* 14: 150–152.

McLeod, R. W. (1967)—*Aphelenchoides bicaudatus,* a parasite of cultivated mushrooms. Nature, 214: 1163–1164.

McLeod, R. W. (1968)—Cereal cyst nematode, a nematode new to N.S.W. Ag. Gaz. N.S.W. 79 (5): 293–295.

McLeod, R. W., and Conroy, R. J. (1968)—Parasitic nematodes of mushrooms in N.S.W. Ag. Gaz. N.S.W. 79 (4): 237–238.

Richards, R. J. (1967)—The effects of bacteriological status of milk as produced on the farm and the quality of products processed from it. First Aust. Dairy Cattle Prod. Rev. Conf.

Robinson, A. C. (1968)—The effect of anti-fungal antibiotics on the nodulation of *Trifolium subterraneum L*, with special reference to the estimation of *Rhizobium trifolii* populations. Aust. J. Exp. Agric. An. Husb. 8: 327–331.

Robinson, A. C. (1967)—The influence of host on soil and rhizosphere populations of clover and lucerne root nodule bacteria in the field. J. of Aust. Inst. of Agri. Sci., 33 (3): 207–209.

Robinson, A. C., Brockwell, J., Dudman, W. F., Gibson, A. H., and Hely, F. W. (1968)—An integrated programme for the improvement of legume inoculants. Trans. Cong. Int. Soil Sci. 9th., Adelaide, 2: 103–114.

Robinson, A. C., Brockwell, J., and Gibson, A. H. (1968)—The nitrogen fixing capabilities of clover nodule bacteria isolated from pastures in southeastern Australia. Aust. Grass. Conf. Vol. 1.

Roughley, R. J., and Vincent, J. M. (1967)—Growth and survival of rhizobium in peat culture. J. of App. Bacteriology. 30 (2): 362–76.

Walker, J., and McLeod, R. W. (1968)—New records of plant diseases in N.S.W. Ag. Gaz. N.S.W. 9 (4): 239–244.

DIVISION OF SCIENCE SERVICES

(ii) CHEMISTRY BRANCH

D. of A. Booklets

Bradley, J., Vimpany, I. A., and Hawkins, C. A. (1967)—Soil tests and how to use them. Bulletin S.75.

Chatfield, M. G. (1967)—Testing water for irrigation and stock. Bulletin S.20.

Contributions to Journals

Cradock, F. W. and Weir, R. G. (1967)—Nitrogen fertilizers. Ag. Gaz. N.S.W. 78 (8): 434–439.

Cradock, F. W., and Weir, R. G. (1968)—Effects and behaviour of nitrogenous fertilizers. Ag. Gaz. N.S.W. 79 (3): 160–168.

McAlpine, B. (1967)—Irrigating from tidal rivers. Ag. Gaz. N.S.W. 78 (11): 647–649.

Saville, D. G., Solvyns, A., and Humphries, C. (1967)—Choline-induced pyridoxine deficiency in broiler chickens. Aust. Vet. Journal, 43 (9): 346–348.

Weir, R. G. (1967)—Elemental sulphur particle size in sulphur-fortified superphosphate. Ag. Gaz. N.S.W. 78 (8): 486–491.

Weir, R. G. and Cradock, F. W. (1967)—Forms of nitrogen fertilizers. Ag. Gaz. N.S.W. 78 (9): 507–512.

Weir, R. G., Cradock, F. W., and Barkus, B. (1967)—Diagnosing deficiencies in plants. Ag. Gaz. N.S.W. 79 (6): 329–339.

DIVISION OF SCIENCE SERVICES

(iii) ENTOMOLOGY BRANCH

D. of A. Booklets

Anon. (1968)—Case moths (Psychidae). Insect pest bulletin 105.

Anon. (1967)—Cutworms and army worms. Insect pest leaflet 31.

Anon. (1967)—The pear and cherry slug. Insect pest bulletin 124.

Anon. (1968)—Red spider: tetranychus sp. Insect pest bulletin 37.

Anon. (1968)—Spiders and their control. Bulletin S32.

Casimir, M. (1967)—The Australian plague locust, *Chortoicetes terminifera.* Insect pest leaflet 30.

Gellatley, J. G. (1968)—Citrus scale insects: Insect pest bulletin 63.

Gibson, F. A. (1967)—Supplement to "Guide to pest destroyers" registered under the Pest Destroyers Act, 1945 (N.S.W.) for the years 1964–65; 1965–66; 1966–67.

Greenup, L. R. (1967)—The blue oat mite: Penthaleus major (Dugès) (Acarina: Eupodidae). Bulletin S76.

Greenup, L. R. (1967)—The sitona weevil—a pest of lucerne (*Sitona rumeralis*). Ag. Gaz. N.S.W. 78 (9): 528–529.

Jones, E. L. (1968)—Oriental fruit moth. Insect pest bulletin 2.

Jones, E. L. (1968)—Pests of the grapevine. Insect pest bulletin 44.

Jones, E. L. (1968)—San Jose scale (quadraspidiotus perniciosus). Insect pest bulletin 27.

Lloyd, N. C., Hutton, K. E., and Johnson, J. F. (1968)—Orchard spray calendar, tablelands and coastal highlands, season 1968–1969.

Shanahan, G. J. (1967)—Tolerance of the sheep blowfly (Lucilia cuprina) to insecticides. Bulletin S77.

Contributions to Journals

Anon. (1967)—Careers in agriculture—Entomologist. Ag. Gaz. N.S.W. 78 (10): 594–595.

Bourke, T. V. and Campbell-Smith, L. (1967)—Insecticide control of *heliothis punctigera.* Wallengr—11. Linseed crop 1961. Ag. Gaz. N.S.W. 78 (9): 543–546.

Gellatley, J. G. (1967)—Citrus blossom bug. Ag. Gaz. N.S.W. 78 (7): 377.

Gellatley, J. G. (1967)—Insecticide treatment of water lily ponds stop caddis fly damage. Ag. Gaz. N.S.W. 78 (7): 421–422.

Gellatley, J. G. (1968)—The spined citrus bug, *Biprorulus bibax* bredd. (Hemiptera: Pentatomidae). Ag. Gaz. N.S.W. 79 (1): 31–33.

Gibson, F. A. (1968)—Citrus red mite, *Panonychus citri* (McGregor) (Tetranychidae: Acari) recorded from N.S.W. Aust. J. Sci. 30 (7): 273.

Gibson, F. A. (1967)—First record of couch grass mite, *Aceria neocynodenis* Keifer (Acari: Euriophyidae) from N.S.W. Ag. Gaz. N.S.W. 78 (12): 742.

Gibson, F. A. (1967)—Lucerne bud mite recorded from N.S.W. Ag. Gaz. N.S.W. 78 (10): 576–577.

Gibson, F. A. (1967)—Mites of camellia. Ag. Gaz. N.S.W. 78 (11): 663–664.

Gibson, F. A. and Gellatley, J. G. (1968)—*Epimegastigmus brevivalvus* gir. (Hymenoptera: torymidae) a parasite of citrus gall wasp in Sydney district. Ag. Gaz. N.S.W. 79 (5): 312–314.

Lloyd, N. C. (1967)—Insect control in pastures. Ag. Gaz. N.S.W. 78 (11): 672–678.

Pasfield, G. (1968)—Argentine ants. Aust. Nat. Hist. 16 (1): 12–15.

ROYAL BOTANIC GARDENS AND NATIONAL HERBARIUM

Briggs, B. G. and Johnson, L. A. S. (1968)—The status and relationships of the Australian species of Typha. N.S.W. Nat. Herb. 4 (2): 57–69.

Johnson, L. A. S. (1967)—*Casuarina monilifera.* In W. M. Curtis: *The Student's Flora* of *Tasmania* 3: 651–653.

Johnson, L. A. S. and Evans, O. D. (1968)—New species in *Eleocharis.* N.S.W. Nat. Herb. 4 (2): 70–72.

Tindale, Mary D. (1968)—A key to the larger species of *Acacia.* In R. H. Anderson. *Trees of N.S.W.* 4th ed.

Tindale, Mary D. (1968)—Notes on Australian taxa of *Acacia* No. 1. N.S.W. Nat. Herb. 4 (2): 73–78.

DECENTRALISED AGRICULTURAL RESEARCH DIRECTORATES

(i) AGRICULTURAL RESEARCH INSTITUTE, WAGGA WAGGA

D. of A. Booklet

Cuthbertson, E. G. (1967)—Skeleton weed—Distribution and control. Bulletin 68: 48.

Contributions to Journals

Cuthbertson, E. G. (1967)—Weed competition in wheat. Proc. Weed Soc. of N.S.W. I:1.

Halloran, G. M. (1967)—Gene dosage and vernalization response in Homoelogous Group 5 of *Triticum aestivum.* Genetics, 57: 401–407.

Halloran, G. M. and Boydell, C. W. (1967)—Wheat chromosomes with genes for vernalization response. Can. J. Genet. Cytol. 9: 632–639.

Kuiper, J. (1968)—Experiments on the control of cereal smuts with a derivative of 1,4-oxathiin. Aust. J. of Exp. Ag. and An. Husb. 8: 232–7.

Pugsley, A. T. (1967)—Wheat breeding in southern N.S.W. Ag. Gaz. N.S.W. 78 (9): 520–525.

Smith, A. N. (1967)—Late applications of superphosphate to wheat are ineffective. Agric. Gaz. N.S.W. 78 (9): 539–40.

Smith, A. N. and Woodward, H. A. (1968)—Care needed in the use of new concentrated fertilizers. Agric. Gaz. N.S.W. 79 (3): 150–151.

Storrier, R. R. (1967)—The estimation of available soil nitrogen. J. Aust. Inst. Agric. Sci. 33: 278–83.

Syme, J. R. (1967)—Growth and yield of irrigated wheat varieties at several rates of nitrogen fertilizer. Aust. J. exp. Agric. An. Husb. 7: 337–341.

(ii) AGRICULTURAL RESEARCH STATION, TAMWORTH

Contributions to Journals

Evans, G. (1967)—Venticilium wilt of cotton . . . the situation in the Namoi Valley. Ag. Gaz. N.S.W. 78 (10): 580–584.

Holford, I. C. R. (1968)—Nitrogen fixation by lucerne on several soils in pot culture. Aust. J. Exp. Agric. and An. Husb. 8.

Wingle, W. V. and Olien, C.R. (1967)—Freezing processes in wheat stems. Aust. J. Biol. Sci. 20: 1025–8.

Contributions to Technical Conferences

Bird, L. H. and Davey, K. M. (1968)—The significance of "maturity" in flour quality evaluation. 17th Annual conference, Cereal Chem. Div., R.A.C.I.

Kohn, G. D. (1968)—Superphosphate and ley farming. Paper 1b–5. 4th Aust. Grasslands Conf.

DIVISION OF MARKETING AND AGRICULTURAL ECONOMICS

D. of A. Booklets

Duncan, R. C. (1967)—Report on an economic survey of the beef cattle industry in the North Coast area of N.S.W. Miscellaneous Bulletin 2.

Elston, J. W. (1967)—Poultry management study in the Sydney area, 1963–64 and 1964–65. Miscellaneous Bulletin 1.

Freebairn, J. W. (1968)—Segregation of N.S.W. wheat: an economic investigation. Miscellaneous Bulletin 4.

Ryan, J. G. (1968)—Financial results of a sample survey of rice farms in the Murrumbidgee Irrigation Area. Miscellaneous Bulletin 3.

Contributions to Journals

Druce, P. C. (1967)—"Organization and administration." *Agriculture in the Australian Economy,* chapter 4 (edited by D. B. Williams), S.U.P., 1967.

Duncan, R. C. (1968)—Factor analysis, a farm management research tool. Rev. of Marketing and Ag. Ecs., 36 (1): 37–46.

Duncan, R. C. (1967)—A linear programming evaluation of pregnancy diagnosis in beef herds. Aust. Vet. J. 43 (12): 598.

Duncan, R. C. (1968)—Pregnancy diagnosis is a highly profitable management aid. Ag. Gaz. N.S.W. 79 (5): 296–297.

Duncan, R. C. (1967)—Priorities in pasture research in the Clarence River Basin. Review of Marketing and Ag. Economics 35 (4): 207–217.

Duncan, R. C., and Wilson, G. P. M. (1968)—Improved pastures for the beef lands of the Clarence Basin: Native versus exotic species. Aust. Grasslands Conf. Perth, May, 1968.

Freebairn, J. W. (1967)—Grading as a market innovation. Review of Marketing & Agricultural Economics. 35 (3): 147–162.

Gallagher, D. R. (1968)—Water distribution policy in the developing region. Proceedings of the Macquarie Valley Development Seminar.

Phillips, J. (1968)—A revised approach to marketing. Review of Marketing and Agricultural Economics. 36 (1): 28–36.

Standen, B. J., and Musgrave, W. F. (1968)—The agricultural adjustment problem with particular reference to Australia. Proceedings of the National Workshop on Agricultural Adjustment in Australia. University of New England, Armidale.

Throsby, C. D. (1968)—Dynamic programming, activity analysis and the theory of the firm. Rev. of Marketing and Ag. Ecs. 36 (1): 20–27.

Throsby, C. D. (1968)—Introduction to mathematical programming. Random House Inc. N.Y. 1968.

Throsby, C. D. (1967)—Stationary-state solutions in multiperiod linear programming problems. Aust. J. of Ag. Ecs. 11. Dec., 1967.

DIVISION OF EXTENSION SERVICES

Contributions to Journals

Costelloe, R. S. J. (1968)—Country cooking. Ag. Gaz. N.S.W. 79 (3): 192.

Foskett, Nancy (1967)—Danger signals. Ag. Gaz. N.S.W. 78 (7): 426.

Jamieson, D. (1968)—Making the most of music. Ag. Gaz. N.S.W. 79 (2): 120–121.

Nichols, Thelma (1967)—Deep freezing pre-cooked foods. Ag. Gaz. N.S.W. 78 (11): 686–687.

Nichols, Thelma (1968)—Aluminium or copper? Ag. Gaz. N.S.W. 79 (5): 318–319.

Nichols, Thelma (1968)—Pots and pans. Ag. Gaz. N.S.W. 79 (4): 250.

Nichols, Thelma (1968)—Enamelware and stainless steel. Ag. Gaz. N.S.W. 79 (6): 383.

BIOMETRICAL BRANCH

Contribution to Journals

Balaam, L. N., Dettmann, E. B., and Moss, H. J. (1968)—The effect of variety and environment of wheat on the volumes of test loaves moulded by hand and by machine. Aust. J. Agric. Res. 19 (2): 203–212.

Smeghy, J. B., and Kirton, H. C. (1967)—Varieties of tomatoes for mechanical harvesting on the Murrumbidgee Irrigation Area of N.S.W. Aust. J. Exp. Ag. An. Husb. 7 (27): 381–383.

Contribution to Conference

Williams, L. G., Butterfield, R. M., and Dettmann, E. B. (1968)—Assessment and improvement of carcass composition in beef cattle. 7th Biennial Conf. Aust. Soc. Anim. Prod.

AGRICULTURAL COLLEGES

(i) Hawkesbury Agricultural College.

(ii) Wagga Agricultural College.

(iii) Yanco Agricultural College.

Publications by officers located in the Colleges are included with publications listed under the various Divisions to which they are responsible.

APPENDIX III

NOTES FROM

A. The Legal Officer.

B. The A./Chief Biometrician.

C. The Personnel Officer.

D. The Staff Clerk.

APPENDIX IIIA

NOTES FROM LEGAL OFFICER

Acts

Three Assisted.—Legal Branch was involved in the work leading to passage of the following Acts by Parliament: the Swine Compensation (Amendment) Act, 1967; the Swine Compensation Taxation Act, 1967; and the Sydney Farm Produce Market Authority Act, 1968.

Regulations, Proclamations, Notifications

141 *Gazettals.*—Legal Branch was involved in the work leading to gazettals of 25 Regulations, 63 Proclamations, and 53 Notifications.

Prosecutions

Eighty-four Informations were prepared by Legal Branch for prosecutions for offences under the various Acts administered by the Department.

Arbitration under Agricultural Holdings Act, 1941

One matter was referred to arbitration under the Act. This was by a tenant, and concerned improvements, disturbances, and adoption of a better standard of farming than required by the contract of tenancy. The Committee made an award in favour of the tenant in respect of improvements only.

Registrations

Registrations effected during 1966–67 and 1967–68 are compared numerically hereunder:

	1966–67	1967–68
Farm produce agents	287	293
Veterinary surgeons	619	686

The Veterinary Surgeons Board met on fifteen occasions this year.

APPENDIX IIIB

NOTES FROM THE A./CHIEF BIOMETRICIAN

Staff

Mr F. C. McCleery, Chief Biometrician, retired on 16th May, 1968, after forty-eight years in the N.S.W. Public Service including forty-seven years as an officer of the Department of Agriculture. He founded the Biometrical Branch after serving as a Plant Pathologist in the Biology Branch of the Department for several years, and the Biometrical Branch has functioned under his leadership since its foundation.

Mr H. C. Kirton who returned in August, 1967, from two years study leave in the United Kingdom was appointed Deputy Chief and has been Acting Chief Biometrician since Mr McCleery's retirement.

Two biometricians resigned during the year, to take positions as statisticians in private industry.

Description of the Branch Work

The Branch continued to provide consultations and advice for other research workers in the Department on design, analysis and interpretation of experiments and surveys. The aims of an investigation, the materials and other resources, the variables to be measured and their likely variations, and magnitudes of expected differences between treatments being tested, are discussd by a biometrician and the particular experimenter to evolve efficient experimental strategy.

When ultimately the data have been obtained from the experiment, mathematical-statistical analysis of the responses is undertaken and advice is given on result interpretation.

Regular visits to Research Stations are made in order to produce better advice on statistical problems and for closer liaison between research workers and biometricians.

Increasing Volume of Work

The volume of work processed has risen rapidly over the past few years, notwithstanding drought effect on number of experiments producing data. The following tabulation summarizes the trend:

Year	Average Number of Biometricians	Experiments Assisted	Variates Analysed
1960-61	2·3	400	527
1961-62	2·9	386	524
1962-63	2·6	435	750
1963-64	3·3	385	793
1964-65	3·0	502	920
1965-66	5·6	373	1,330
1966-67	6·2	506	1,645
1967-68	7·8	1,263	3,635

The big increase in number of variates analysed has been possible only by the use of three major computer programmes. Another factor is the increasing total of research workers in the Department.

The Punch-Card Section

Following the Departmental ADP Section's completion (in June, 1966) of writing computer programmes for processing the records from Dairy Herd Recording, the Punch-Card Section now only punches Herd Recording data into cards for input to computers. But, whereas the Punch-Card Section originally processed only Dairy Herd Recording records, the Section now also punches and verifies substantial volumes of computer programmes (biometrical, economics, and data processing) and of research data for biometric analysis. This, in fact, comprises about 30 per cent of the workload.

Appendix IIIC

NOTES FROM THE PERSONNEL OFFICER

Induction Activities

Personnel Section inducted 215 officers and employees.

Interview Check-list. A more thorough method of inducting new personnel who take up their duties through head office has been introduced. It includes a check-list providing more reliable follow-up interviews. A similar check-list has been planned for use at country offices in the case of directly recruited employees.

University and College Trainees. Induction was organized for 65 trainees recruited early in 1968 for studies at the University of Sydney, University of New South Wales, University of New England, and Macquarie University, and the Hawkesbury and Wagga Agricultural Colleges. They attended a 5-days' induction course. The course included 3 days at Wagga Agricultural College, where Departmental activities in general were discussed.

There are now 212 Department of Agriculture trainees at the various Universities and Agricultural and Technical Colleges. Eighteen are currently repeating an academic year at their own expense.

Staff Assessment, Reporting, and Guidance Scheme

The scheme was introduced in the Department this year. At present it applies to officers and employees in the Administrative and Clerical Division within the incremental ranges, also to shorthandwriter/typists up to and including Grade I and to office assistants in the General Division up to and including Grade I. Thirteen courses to train the reporting and reviewing officers were conducted in city and country areas.

Counselling, and adjustment advice and guidance were provided for a number of officers. Some cases were referred to specialists at the Public Service Board.

Staff Bulletin—"Newsletter for Staff Members"

Created this year, the staff bulletin is published monthly. The main objective is to provide topical information concerning the Department and Public Service, but the bulletin is also being used to encourage an interest in amenities, social activities, the Credit Union, etc.

Career Inquiries Serviced

Appropriate Departmental publications and information were provided for parents, students, career advisers, and various organizations inquiring about professional or technical careers within the Department. The Personnel Section handled some 500 inquiries of the sort. Some of the inquiries were from persons in overseas countries.

Assistance for Colombo Plan and Other Fellows

Personnel Section organized opportunities for one Colombo Plan Fellow from Pakistan to study carcass inspection and appraisal methods, one from the Philippines to study veterinary diagnostics, and one from Malaysia to study dairy technology. Training in sheep management and disease control was set up for one F.A.O. Fellow from Tanzania. Under the Special Commonwealth African Assistance Plan training in agricultural education was organized for a Fellow from Tanzania and for one from Ghana in veterinary diagnostics. Training in agricultural education was organized, also, for a Fellow visiting under the Australian South Pacific Technical Assistance Programme. A visitor from Brazil, sponsored by his Government, was assisted to a study of tropical pastures. A miscellaneous group concerned with port and harbour administration was helped to acquire information in respect of animal and plant quarantine work.

The Department also co-operated with the Commonwealth by providing teaching personnel and field activities in various courses organized by Department of External Affairs for groups of specialists drawn from developing Asian, African, and Pacific countries.

Appendix IIID

NOTES FROM THE STAFF CLERK

Salary Agreements, Determinations, Awards Processed

Fifteen new salary agreements, six new salary determinations and six new salary awards received were processed by Staff Branch for the adjusted rates of payment to the individuals within the various categories of personnel affected.

Staff Numbers

At 30th June, 1968, the Department's officers and employees totalled 3,817 (2,789 Public Service Board appointees and 1,028 Ministerials, including 31 casuals).

The 111 new positions established during the year comprised 30 Professional Division, 18 Administrative and Clerical Divison, and 63 General Division positions.

Some Notable Promotions/Appointments

Promotions/appointments during the year included the following, tabulated in alphabetical order: *Mr B. D. Ament,* from Principal Extension Officer (Regional Services) to Acting Chief of Regional Extension Services and later to the newly-established position of Chief of Division of Extension Services; *Mr E. Boersma* to Senior Field Officer (Weeds); *Mr R. J. Conroy* from Plant Pathologist to Deputy Chief Biologist; *Dr L. R. Fraser* from Deputy to Chief Biologist; *Dr S. G. Grimmett* to Director of Research, Wollongbar Agricultural Research Station; *Mr K. E. Hutton* from Executive Assistant of the Deputy Director General (Research and Education) to Research Co-ordinator (a position formerly designated Chief of Research Administration); *Mr J. E. Jessup* from Principal Agronomist (Miscellaneous Crops) to Executive Assistant of Deputy Director General (R.E.); *Mr J. F. Johnson* from Assistant Principal Fruit Officer to Principal Fruit Officer (Pome Fruits); *Mr L. A. S. Johnson* from Botanist to Deputy Chief Botanist; *Mr H. C. Kirton* from Senior to Acting Chief Biometrician; *Mr M. J. R. MacKellar* from Extension Officer (Agricultural Bureau) to Assistant Principal Extension Officer (Group Extension); *Mr F. W. Marriner* to Principal Dairy Officer (Research); *Mr R. Milburn* from Inspector to Deputy Senior Inspector, Export and Import Branch; *Mr G. A. Pasfield* from Senior to Chief Entomologist; *Dr G. J. Shanahan* from Entomologist to Deputy Chief Entomologist; *Dr G. J. F. Smith* from Principal Dairy Officer (H.A.C.) to Deputy Chief, Division of Dairying; *Dr C. D. Throsby* from Economics Research Officer to Supervisor of Research, Division of Marketing and Agricultural Economics; and *Mr R. V. Wilson* to Senior Port Inspector.

Some Retirements

Retirements included the following, tabulated in alphabetical order: *Mr C. E. Chapman,* Deputy Chief, Division of Dairying; *Miss N. M. Foskett,* Senior Extension Officer (Women's Service); *Mr J. L. Green,* Chief of Regional Extension Services; *Dr R. Gottl,* Research Agronomist; *Mr S. P. Hebden,* Assistant Principal Veterinary Officer; *Mr P. C. Hely,* Chief Entomologist; *Dr S. L. Macindoe,* Chief of Research Administration; *Mr F. C. McCleery,* Chief Biometrician; *Mr L. F. Mandelson,* Manager, Narara Horticultural Research Station *Mr W. S. Sutton,* Chief Biologist; *Dr J. W. Vickery,* Senior Botanist; and *Mr E. C. Whittaker,* Principal Fruit Officer (Pome Fruit).

Deaths

Mr K. W. Hirst, Meat Inspector.

Mr R. Howe, Deputy Senior Inspector, Export and Import Branch.

Mr P. J. McEncroe, Meat Inspector.

Mr L. H. Nolan, Meat Inspector.

Mr J. R. Williams, Senior Clerk, Division of Marketing and Agricultural Economics.

Mr J. T. Winbank, Cereal Pure Seed Officer.

Officers Officially Overseas for Post-graduate Studies or Special Purposes

The following 16 professional officers were, and in the majority of cases are still overseas: *M. G. Chatfield,* Chemist, for 95 days from May, 1968, to study water quality problems, salinity, etc., in Israel, Europe, U.S.A.; *L. S. Edwards,* Regional Publicity Officer, for 6 months from March, 1968, to study mass media communication in U.S.A. and U.K.; *R. E. Everett,* District Veterinary Officer, for 10 months from October, 1967, for post-graduate studies at the University of London and to investigate animal disease matters in the U.K.; *G. R. Hughes,* Agronomist, for 3 years from September, 1965, for post-graduate studies at the University of Illinois; *B. C. Imrie,* Agronomist, for 2 years from August, 1966, for post-graduate studies at the University of California; *C. J. King,* Chief, Division of Marketing and Agricultural Economics, in New Guinea from 28th March to 6th April, 1968, re rice exports to New Guinea; *G. L. G. Lee,* Livestock Research Officer (Apiculture), for 3 years from September, 1965, for post-graduate studies at the University of California and to present a paper at the World Congress on Genetics, Tokyo; *D. R. Leece,* Chemist, for 3 years from September, 1967, for post-graduate studies at the University of Michigan; *D. J. McDonald,* Agronomist, for 3 years from September, 1967, for post-graduate studies at the Texas A. & M. University and visit Asia and Mexico on rice matters; *H. Mareellos,* Agronomist, for 3 years from September, 1967, for post-graduate studies at the University of Illinois; *B. J. Moraghan,* Agronomist, for 3 years from September, 1967, for post-graduate studies at Iowa State University; *J. Nolan,* Livestock Research Officer, for 4 years from August, 1965, for post-graduate studies at Cornell University; *R. D. Pares,* Plant Pathologist, for 9 months from September, 1967, for training in the U.S.A. in electron microscopy re virus diseases and to visit research centres in U.S.A., Canada, U.K., Europe; *R. J. Roughley,* Bacteriologist, for 3 years from August, 1966, for post-graduate studies at University of London; *J. A. Thompson,* Senior Research Officer, for 10 months from February, 1968, in Uruguay for a Uruguayan Government assignment; *N. W. Vane,* Regional Supervisor, for 95 days from May, 1968, to attend 16th International Course in Rural Extension at the University of Wageningen, The Netherlands, and to study extension services in W. Europe, U.K., N. America, S. Africa, and Fiji.

Officers at Universities within Australia for Post-graduate Studies

The following 19 professional officers were, and in the majority of cases are still at Universities within Australia—working towards higher degrees in subject matter areas appropriate to the Department's responsibilities: *T. S. Abbott,* Chemist, at University of Sydney for 3 years from January, 1967; *M. E. Bourke,* Plant Pathologist, at University of Adelaide for 3 years from January, 1967; *M. H. Campbell,* Agronomist, at University of New England for 3 years from January, 1968; *R. L. Colman,* Research Officer, at University of New England for 3 years from March, 1967; *G. P. Gard,* Veterinary Research Officer, at the Australian National University for 3 years from June, 1967; *B. A. Hamilton,* Livestock Research Officer, at the University of New England for 2 years from September, 1967; *D. W. Hennessey,* Livestock Research Officer, at the University of New England for 3 years from February, 1966; *L. A. Hilton,* Soil Chemist, at the University of Sydney for 2 years from March, 1968; *B. J. Hollingdale,* Dairy Research Officer, at the University of Sydney for 3 years from February, 1965 (and to visit Japan for World Congress in Genetics); *I. D. Killeen,* Livestock Research Officer, at University of Sydney for 3 years from February, 1966; *R. D. Macadam,* Research Officer, at the University of Melbourne for 9 months from March, 1968, for the post-graduate Diploma in Extension; *P. A. McInnes,* Livestock Research Officer, at the University of Western Australia for 2 years from March, 1967; *H. D. R. Malcolm,* Fruit Research Officer, at The Macquarie University for 2 years from March, 1966; *E. M. Matheson,* Senior Research Officer, at the University of New England for 2 years from March, 1966; *M. L. Reed,* Fruit Research Officer, at University of Sydney for 4 years from February, 1965; *G. E. Robards,* Livestock Research Officer, at the University of Melbourne for 2 years from January, 1968; *A. M. Smith,* Plant Pathologist, at the University of Adelaide for 2 years from January, 1967; *N. L. Wade,* Fruit Research Officer, at the University of Sydney, for 3 years from January, 1967; and *A. J. Williams,* Wool Biologist, at the University of New England for 3 years from April, 1966.